SYS2334U/D1

System Manual
For
VME Delta Series Model 2334

MOTOROLA INC.

SYSTEMS

MOTOROLA

SYS2334U/D1

JANUARY 1988

SYSTEM MANUAL

FOR

VME DELTA SERIES MODEL 2334

WARNING

THIS EQUIPMENT GENERATES, USES, AND CAN RADIATE RADIO FREQUENCY ENERGY AND IF NOT INSTALLED AND USED IN ACCORDANCE WITH THE INSTRUCTIONS MANUAL, MAY CAUSE INTERFERENCE TO RADIO COMMUNICATIONS. IT HAS BEEN TESTED AND FOUND TO COMPLY WITH THE LIMITS FOR A CLASS A COMPUTING DEVICE PURSUANT TO SUBPART J OF PART 15 OF FCC RULES, WHICH ARE DESIGNED TO PROVIDE REASONABLE PROTECTION AGAINST SUCH INTERFERENCE WHEN OPERATED IN A COMMERCIAL ENVIRONMENT. OPERATION OF THIS EQUIPMENT IN A RESIDENTIAL AREA IS LIKELY TO CAUSE INTERFERENCE IN WHICH CASE THE USER, AT HIS OWN EXPENSE, WILL BE REQUIRED TO TAKE WHATEVER MEASURES NECESSARY TO CORRECT THE INTERFERENCE.

First Edition

SAFETY SUMMARY
SAFETY DEPENDS ON YOU

The following general safety precautions must be observed during all phases of operation, service, and repair of this equipment. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the equipment. Motorola Inc. assumes no liability for the customer's failure to comply with these requirements. The safety precautions listed below represent warnings of certain dangers of which we are aware. You, as the user of the product, should follow these warnings and all other safety precautions necessary for the safe operation of the equipment in your operating environment.

GROUND THE INSTRUMENT.

To minimize shock hazard, the equipment chassis and enclosure must be connected to an electrical ground. The equipment is supplied with a three-conductor ac power cable. The power cable must either be plugged into an approved three-contact electrical outlet or used with a three-contact to two-contact adapter, with the grounding wire (green) firmly connected to an electrical ground (safety ground) at the power outlet. The power jack and mating plug of the power cable meet International Electrotechnical Commission (IEC) safety standards.

DO NOT OPERATE IN AN EXPLOSIVE ATMOSPHERE.

Do not operate the equipment in the presence of flammable gases or fumes. Operation of any electrical equipment in such an environment constitutes a definite safety hazard.

KEEP AWAY FROM LIVE CIRCUITS.

Operating personnel must not remove equipment covers. Only Factory Authorized Service Personnel or other qualified maintenance personnel may remove equipment covers for internal subassembly or component replacement or any internal adjustment. Do not replace components with power cable connected. Under certain conditions, dangerous voltages may exist even with the power cable removed. To avoid injuries, always disconnect power and discharge circuits before touching them.

DO NOT SERVICE OR ADJUST ALONE.

Do not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present.

USE CAUTION WHEN EXPOSING OR HANDLING THE CRT.

Breakage of the Cathode-Ray Tube (CRT) causes a high-velocity scattering of glass fragments (implosion). To prevent CRT implosion, avoid rough handling or jarring of the equipment. Handling of the CRT should be done only by qualified maintenance personnel using approved safety mask and gloves.

DO NOT SUBSTITUTE PARTS OR MODIFY EQUIPMENT.

Because of the danger of introducing additional hazards, do not install substitute parts or perform any unauthorized modification of the equipment. Contact Motorola Field Service Division for service and repair to ensure that safety features are maintained.

DANGEROUS PROCEDURE WARNINGS.

Warnings, such as the example below, precede potentially dangerous procedures throughout this manual. Instructions contained in the warnings must be followed. You should also employ all other safety precautions which you deem necessary for the operation of the equipment in your operating environment.

WARNING

Dangerous voltages, capable of causing death, are present in this equipment. Use extreme caution when handling, testing, and adjusting.

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CHAPTER 1 - INTRODUCTION

1.1 OVERVIEW

This manual describes the VME Delta Series Model 2334. The first chapter provides an introductory system description and information about related documentation for the hardware and software.

Chapter 2 provides information for site preparation and system installation. Chapter 3 describes procedures for initial start-up, both hardware and software. Chapter 4 provides descriptions of system hardware configurations and components. Chapter 5 describes system diagnostics and Chapter 6 gives an overview of system software. Six appendices provide reference information, including system specifications, terminals, printers, cabling, using removable media, and equipment maintenance.

Throughout this manual, the following conventions identify arguments, literals, and program names:

Boldface strings are literals and program names, to be typed as they appear.

Italic strings represent substitutable argument prototypes.

Square brackets ([ ]) indicate that an argument is optional.

Ellipses (...) show that the previous argument prototype may be repeated.

Unless otherwise specified, all address references are in hexadecimal.

1.2 SYSTEM DESCRIPTION

The VME Delta Series of 32-bit computer systems is based on the MC68020 microprocessor, the VMEbus standard, and UNIX System V Release 3 software.

The Model 2334 uses the 16.7 MHz MC68020 microprocessor and supports up to ten serial devices. The system enclosure accommodates one hard disk drive, one (half-high) floppy disk drive, and a streaming tape drive. Both Local Area Network (LAN) and Wide Area Network (WAN) communications protocols link the Model 2334 to industry standard networks as well as host computers.

The Model 2334 hardware includes:

- 6-Slot Enclosure (either 110V or 220V)
- VMEbus
- Memory (Parity or ECC)
- I/O and Communications Controllers
- Mass Storage Devices
- Local and Remote Diagnostic Capabilities

The VME Delta Series 2334 enclosure has a 6-slot VME card cage and a 6-slot VME cable connection area. This provides connectivity to a diverse and large number of peripheral devices. The enclosure contains a 400 watt switching power supply. Two fans provide cooling.

The Model 2334 has four basic configurations: two combinations of components, each of which is available in a 110V or 220V version. Detailed descriptions of configurations and individual modules are provided in Chapter 4.

SYSTEM V/68 Release 3 is furnished on the hard disk. Release 3, which is Motorola's version of AT&T's UNIX System V Release 3, includes the following features:

- Remote File Sharing (RFS), which allows users to share files, data, and peripheral devices across computer systems attached to a Local Area Network (LAN).
- STREAMS, which supports application development independent of underlying network protocols.
- Virtual memory and demand paging support for efficient memory utilization and simpler application development.
- Menu interface for system administration functions.
- Support for the MC68881 floating point co-processor.
- Complete backup and restore facilities.

SYSTEM V/68 Release 3 is compliant with AT&T's System V Interface Definition (SVID).

1.3 DOCUMENTATION ROADMAP

Several types of documentation describe the Model 2334 with SYSTEM V/68 Release 3.

The software is described in multi-volume binder sets. A brief description of the contents of each document is given in the following list:

SYSTEM DEVELOPMENT DOCUMENTATION SET - 68-43823G02

VOLUME I

Programmer's Reference Manual, MU43814PR. This document contains manual pages for programming commands (Section 1), system calls (Section 2), library subroutines and functions (Section 3), file formats (Section 4), and miscellaneous facilities (Section 5).

VOLUME II

Programmer's Guide, MU43815PG. This two-part document describes the operating system programming environment and provides detailed descriptions of many programming tools, including: shared libraries; screen-handling programs; File and Record Locking facilities; Inter-Process Communication facilities; **awk**(1) language and command; **lex**(1) lexical analysis tool; **make**(1) utility for maintaining, updating, and regenerating groups of programs; **sccs**(1) (Source Code Control System); **sdb**(1) symbolic program debugger; and **yacc**(1) compiler-compiler.

VOLUME III

STREAMS Programmer's Guide, MU43817SPG. This document is divided into three parts. The first part describes the use of user-level STREAMS facilities. The second part describes programming use of STREAMS facilities to write kernel modules and device drivers. The third part provides a summary of kernel-level data structures, message types, and kernel utility routines.

STREAMS PRIMER, MU43818SPR. This document provides a high-level overview of the STREAMS support for networking services, including terminology, a summary of the mechanism, a simple example, a discussion of each of the STREAMS facilities, and a comparison of design features of character I/O device drivers with STREAMS modules and drivers.

Remote File Sharing Reference Card, MU43822RC.

DIAGNOSTICS SET - 68-43824G02

Terminal and Printer Diagnostics User's Guide, MD41957TPD. This document describes how to configure, use, and maintain the Terminal and Printer Diagnostics (TPD) program designed for Motorola computer systems.

Standalone System Interactive Diagnostics User's Guide, MD41955SID. This document describes the program that tests and diagnoses system problems through a menu system that includes extensive help screens that describe the various tests and commands.

END USER DOCUMENTATION SET - 68-43821G02

VOLUME I

User's Reference Manual, MU43810UR. This document contains manual pages for user commands (Section 1). An Introduction describes how to use the manual and gives basic information for getting started on the operating system.

System Administrator's Reference Manual, MU43812SAR. This document contains manual pages for administrative commands (Section 1M), system devices (Section 7), and procedures (Section 8).

VOLUME II

User's Guide, MU43811UG. This document provides an introduction to the use of the operating system, including a general description; using a terminal; using the file system; the line editor, **ed**(1); the screen editor, **vi**(1); shell programming, **sh**(1); electronic mail; and the UNIX-to-UNIX CoPy (**uucp**(1C)) program.

VOLUME III

System Administrator's Guide, MU43813SAG. This document provides instructions on how to do administrative tasks and background information about when and why the tasks should be performed. Major subject areas include the processor, the file system, user services, peripheral devices, networking, inter-machine communication, security, performance management, disk partitioning, device names, and error messages.

Release Notes, MU43819SRN. This document provides a summary of new features, transition information, special instructions for installing some utilities packages, upgrade instructions, and a documentation summary.

ADDITIONAL DOCUMENTATION

Network Services Extension Release Notes, MU43825NSE.

System Administration Procedures Reference Card, MU43827RC.

Hardware components are described in the following manuals:

MVME134 VMEmodule 32-bit Monoboard Microcomputer User's Manual, MVME134.

MVME705A 6-Channel Serial Transceiver User's Manual, MVME705A.

MVME350 Streaming Tape Controller VMEmodule User's Manual, MVME350.

MVME333 Intelligent Communication Controller User's Manual, MVME333.

MVME335 Serial and Parallel I/O Module User's Manual, MVME335.

MVME320B VMEbus Disk Controller Module User's Manual, MVME320B.

MVME330 Ethernet Controller User's Manual, MVME330.

MVME332XT Intelligent Communication Controller User's Manual, MVME332XT.

MVME710 8-Channel Serial I/O Distribution Module User's Manual, MVME710.

MVME716 Serial I/O Distribution Module User's Manual, MVME716.

Other documents include:

VMEbus Specification Manual, Rev C.1, HB212.

UNIX SYSTEM V PRIMER, TB311.

C PRIMER PLUS, TB310.

CHAPTER 2 - INSTALLATION

2.1 SITE PREPARATION

Setting up the proper working environment for computer equipment can greatly increase its reliability and utility. This section provides guidelines for site preparation before installation of the Model 2334.

2.1.1 Power Requirements

Power for the Model 2334 should be supplied from a totally dedicated circuit breaker. Do not plug other electrical items into an outlet that is connected to the circuit breaker serving the computer. Making the computer share a circuit with other electrical equipment is an invitation to losing data if the circuit is overloaded and the breaker is tripped.

The branch AC power circuit used to supply the 110V computer may be either a 15A or 20A type. For protection of data in the computer, disable all other outlets not used by the computer that are on the same branch circuit. It is suggested that adhesive labels be placed over outlets in order to prevent their use.

NOTE

The circuit breaker on the branch circuit is not for the protection of the computer.

Using a "power strip" with its own circuit breaker does not help protect the computer. The object is to prevent having some other appliance draw enough power from the same branch circuit to cause the branch circuit breaker to trip or reduce the branch circuit voltage below acceptable levels.

Along with the computer, one branch circuit can also be used for the system console.

The ground wire in the 3-wire power distribution must be at true ground potential with a resistance (measured at the power panel bus) of 5 ohms or less between the outlet and earth. The ground must be "third wire" type, not conduit ground.

The Model 2334 is equipped with a separate power cord and should be placed within 6 feet of the electric receptacle. If absolutely required, extension cords are to be #16 or #14 AWG, or larger, with ground.

Computers for U.S. domestic customers that will be used with 120 volt, AC input are shipped with a 3-prong male plug on the power cable (NEMA type 5-15P). The computer has the power supply set for the correct input voltage at the factory. If any doubt exists about this setting, have it checked by a qualified technician before applying power. Computers for international shipment may require local installation of the correct cord set.

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2.1.2 Electro-Static Discharge

The Model 2334 is designed to withstand 12 kV (kilovolts) of Electro-Static Discharge (ESD) without system interference and up to 24 kV without damage to the equipment.

The system is designed to operate in an area with 10% to 80% non-condensing relative humidity. A dry area (below 20% relative humidity) is conducive to ESD problems.

2.1.3 Cables

Terminals, printers, and some other peripherals use Motorola RS-232C cables. Use of cables other than those supplied with the system is not recommended (refer to section 3.3, "Troubleshooting"). The maximum recommended length for RS-232C cables is 50 feet (15 meters). Reliable communication over cables longer than 50 feet depends on the absence of electrical noise, correct ground potentials at termination points, and other variables. For this reason, error-free communication cannot be guaranteed on RS-232C cables longer than 50 feet. An alternative solution to extending cables is to use "short-haul" modems for devices further than 50 feet from the computer processor.

Refer to section 2.3.1, "System Console," and Table 3-2, "Troubleshooting Hints," for additional requirements for console cables.

To achieve maximum reliability, use the following cautions when planning the installation of cables.

- Do not run signal cables parallel to AC power cables for more than a few feet if they are within four inches of each other.
- Do not install signal cables close to electric motors, power line regulators, relays, or power supplies.
- Avoid laying signal cables close to air conditioners, copy machines, water coolers, and other similar equipment that generates power line "noise."
- Do not run signal cables near equipment that generates radio frequency interference (e.g., radio transmitters).
- Do not lay signal cables outside buildings without protecting from lightning and weather.
- Use the shortest possible cable between the processor unit and peripherals.
- To ensure that maximum protection for the equipment and operators is achieved, check the protective grounds at each power outlet for adequacy.

2.1.4 Remote Maintenance

Remote maintenance is an optional feature of the VME Delta Series Model 2334 which is implemented with an internal modem cabled to the MVME716 module. The user must provide a separate phone number by installation time to enable the remote maintenance connection for the service.

The Model 2334 can use the phone line to inform the service facility if it is experiencing difficulties that may be indicators of more serious problems. The service center, with the user's permission, can log on to the Model 2334 to help diagnose operational problems.

Some internal PABX (telephone switchboard) systems interfere with the modem. The telephone line for remote maintenance should be independent from an internal PABX.

For more detailed information on the remote maintenance feature, contact a sales representative or Motorola Field Service Division representative.

2.2 MECHANICAL FEATURES

A front view of one configuration of the Model 2334 is shown in Figure 2-1. The following items may be identified:

- A full-height cartridge tape drive
- Power ON/OFF switch

The back panel of a Model 2334 is shown in Figures 2-2 and 2-3. The number of connectors on an individual system varies, depending on the configuration. The Model 2334 may have the following connectors on the rear of the unit:

- Two RS-232C connectors of the MVME716 module located on the right. The lower connector is used to connect the system console terminal. The upper connector is normally used to connect the internal modem and is therefore not available if the remote maintenance feature is installed. The upper connector may be used to connect a terminal or printer, but limitations apply and configuration changes are required.
- Up to eight additional RS-232C serial connectors for various combinations of serial terminals, printers, and modems. There may be eight connectors labeled SP1 through SP8, representing the eight ports on the MVME332XT module, as shown in Figure 2-2. In a configuration with an MVME335 module, there are four serial connectors and one parallel printer connector, as shown in Figure 2-3.
- One connector labeled "Telco" (optional) to connect the internal modem to the remote maintenance facility.
- One power cord connector.

2.3 PERIPHERAL EQUIPMENT

This section provides procedures for installing the system console, terminals, printers, and modems.

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2.3.1 System Console

The system console is the terminal from which system administrative functions should be performed. The cable that is used to connect this terminal is the same as for any other terminal; however, the system console cable must be attached to the connector labeled CONSOLE on the rear panel of the system.

Use the following procedure to connect the system console and the power cord on the system.

1. Select an RS-232C cable labeled WORKSTATION/PRINTER. Choose the terminal that is to be the system console. On the back of the terminal, locate the connector for the cable that will connect the terminal to the system. Connect the end of the cable labeled WORKSTATION/PRINTER to this port.

NOTE

Console cable must be WORKSTATION/PRINTER (DTE to DTE type), Motorola Part Number 30-W2849B01 or equivalent.

2. On the rear of the Model 2334, identify the connector labeled CONSOLE. It is located on the right-hand side of the rear panel. Connect the other end of the RS-232C cable (labeled DPU) to this connector.

3. Plug one end of the system's power cord into the input power connector located at the rear of the system on the top left side. When the system installation is finished, plug the other end of the system's power cord into an electrical outlet.

4. Plug one end of the terminal's power cord into the power connector located at the rear of the terminal. When the system installation is finished, plug the other end of the terminal's power cord into an electrical outlet.

CAUTION

DISCONNECT THE POWER CORDS FOR THE SYSTEM AND THE SYSTEM CONSOLE FROM THE ELECTRICAL OUTLET BEFORE INSTALLING THE OTHER PERIPHERALS. RECONNECT THE SYSTEM AND THE PERIPHERALS TO AN ELECTRICAL OUTLET AFTER THE ENTIRE SYSTEM IS CABLED TOGETHER.

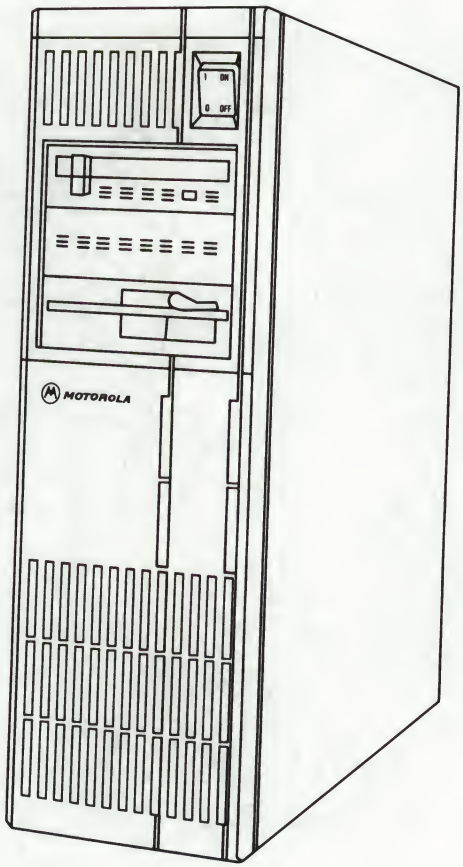


FIGURE 2-1. Model 2334 Front View

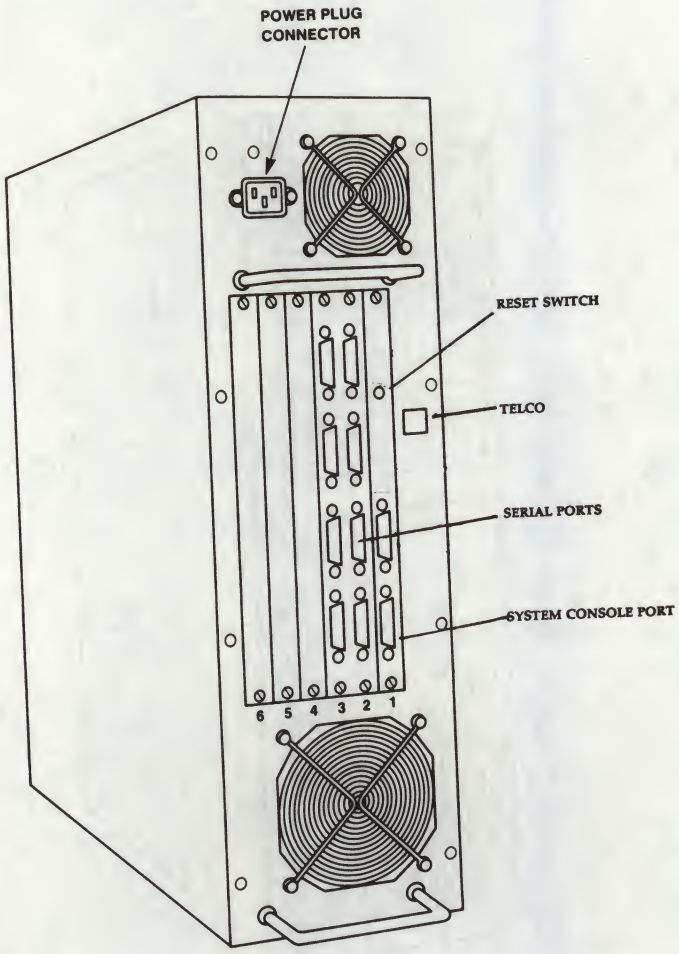


FIGURE 2-2. Model 2334 Configured With MVME332XT

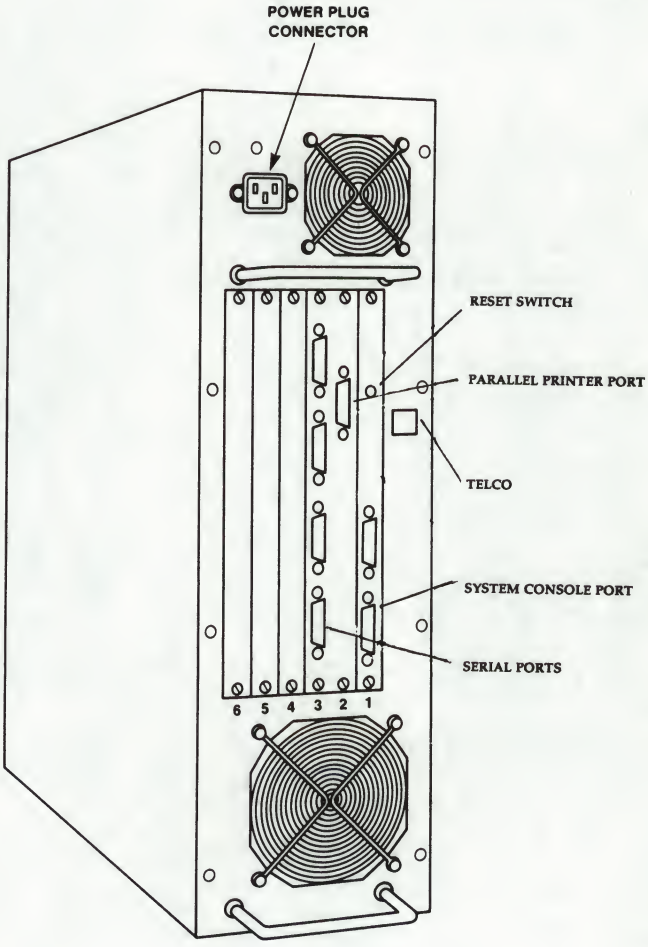


FIGURE 2-3. Model 2334 Configured With MVME335

2

2.3.2 Terminals, Printers, Modems

The Model 2334 can have 6 to 10 RS-232C connectors to connect combinations of serial terminals, printers, (one parallel port), and/or modems. To connect these peripherals, use the procedure described for the system console in section 2.3.1, but connect the cable to a port labeled **SP***x* on the rear panel, where *x* is a number from 1 through 8 (refer to Figure 2-2).

Refer to Appendix B for information about terminals supplied by Motorola for use with the Model 2334. Appendix C provides information about printers; cabling instructions are in Appendix D.

CHAPTER 3 - GETTING STARTED

3.1 SYSTEM POWER-UP

3.1.1 Controls and Indicators

The system power switch is located at the upper right side of the front of the system (refer to Figure 2-1). Move the rocker switch to the ON (1) position to power up the system or to the OFF (0) position to power down the system. When the system is powered up, a reset is also performed.

When the floppy disk drive or cartridge tape drive is accessed, the associated drive's LED is illuminated.

3.1.2 Power-Up Procedures

To power up the system, follow these steps:

1. Plug all power cords into their respective electrical outlets.
2. Power up the system console. Some terminals take a minute or two to warm up and perform self-tests.
3. Power up the Model 2334 by turning the ON/OFF switch to the ON position.
4. Power up all the other peripherals, such as terminals, or printers.

3.2 BOOTING THE SYSTEM

3.2.1 Autoboot

Following power-up, the Model 2334 goes through a minimal set of self-tests as part of the autoboot procedure. If the tests are successful, a copyright statement, a current revision number of the System Self Test firmware and the System Monitor firmware, and the following message is displayed on the system console screen in about ten seconds:

```
FPC passed test
PMMU passed test

(pause)
```

"FPC" refers to the Floating Point Co-processor and "PMMU" refers to the Paged Memory Management Unit. The FPC and PMMU lines will display messages indicating whether the tests were passed or failed or that the FPC/PMMU options were not detected.

If no operator interaction is done, the system will attempt to autoboot at this time.

NOTE

After the "System Self Test" message is displayed, there is a five-second delay. During this delay the start-up sequence can be halted by typing the letter h (for halt). A special menu is then displayed. Refer to paragraph 3.2.2 for information on how to use this menu.

After the system has gone through the initial self-tests, it performs some extended self-tests. During this testing, a display line appears on the screen with the name of each test being performed followed by either the word **PASSED** or the word **FAILED**. This display line changes rapidly.

If all the extended self-tests are successful, the following message appears on the console screen:

```
Testing Complete

Autoboot in progress ...     To abort hit <BREAK>
```

If autoboot fails, the following message appears:

```
Autoboot failed

Booting from VMEnnn Controller = x  drive = y
```

The *x* represents the controller number and the *y* represents the drive number. The type of controller (**VME***nnn*) depends on the configuration; e.g., **VME323** or **VME320**. The autoboot sequence attempts to boot from the Winchester drives in the following order:

```
First:  MVME323 ESDI (addr 8,0)
Second: MVME320B ST-506 (addr 0,0)
```

If the extended self-tests fail, contact your service representative.

At this point, the operating system is loaded into system memory. Several messages appear on the console screen concerning release information, amount of real and available system memory, and general start up information. The system console then displays the following:

```
Is the date day  month  date  time  time-zone year  correct?  (y or n)
```

Type **n** for "no" and enter the correct date and time, using the format

mmddhhmmyy

where *mm*=month, *dd*=day, *hh*=hour, *mm*=minute, and *yy*=year (refer to **date**(1) in the SYSTEM V/68 Release 3 User's Reference Manual).

For example,

0930153787

is the entry for September 30, 1987 at 3:37 p.m. Remember that the month, day, hour, minute, and year must each be a two-digit number with no blanks in the format. The entry for year is optional but should be set to the correct year. Failure to do so may cause problems with **make**(1) files and accounting procedures. In addition, the clock does not understand a.m. and p.m., so the time is entered in military format (24-hour clock).

The file system is then checked automatically. During the file system check, various messages appear on the console screen relating to the system check. When the file system check has completed, a series of messages will appear ending with:

The system is ready.

and the login prompt:

Console Login:

The system is now ready for use. Note that whenever the system is powered up and booted, it moves automatically through single-user mode to multi-user mode. Single-user mode might be more appropriately named "System Maintenance Mode" because its correct use is to install software on the root device, back up and restore file systems, perform file system checks, and recover from crashes. All other system administrative functions can be performed in multi-user mode. To enter single-user mode, use the shutdown procedure described in section 3.4.1.9. For additional information about operating levels, refer to Chapter 3, "Processor Operations," in the SYSTEM V/68 Release 3 System Administrator's Guide.

3.2.2 Power-Up Menu

As described in the system power-up, a five-second delay occurs during the display of the system self-test message. During this delay, the start-up sequence can be halted by typing the letter **h** (halt). A special menu called the Service Menu then appears on the screen. This menu is also displayed if the system fails the self-test or if a primary boot device is not available for bootloading. The Service Menu can also be displayed after extended SST starts by pressing the "BREAK" key.

```
1) Continue System Start-up
2) Select Alternate Boot Device
3) Go To System Debugger
4) Initiate Service Call
5) Display System Test Errors
6) Dump Memory to Tape
Enter menu #:
```


To select one of these menu items, enter the menu item number (1-6) followed by a carriage return. The options are discussed in the following paragraphs.

If the system self-test fails, an error message is displayed on the system console screen. If this happens AND the remote maintenance service is present on your system, call the service number provided, and you will receive instructions to initiate a remote service call. If you do not have the remote maintenance facility, call your service representative.

3.2.2.1 Option 1: Continue System Start-Up

To continue the system start-up process, type **1** in response to the Service Menu. This menu item is usually selected after completion of one of the other menu items. For example, after selecting an alternate boot device using menu item #2, the system returns the Service Menu to the screen. The user then types **1** to continue system start-up. Selecting menu item 1 will always cause system start-up to begin from the first Extended System Self Test.

3.2.2.2 Option 2: Select an Alternate Boot Device

To select a boot device other than the default device (controller 8, drive 0), type **2** in response to the Service Menu. The following prompt is then displayed:

```
Enter Alternate Boot Device (Controller, Drive, File):
x,y,z
```

where *x* is the controller to be accessed, *y* is the drive, and *z* is the file to be loaded.

The system has an autoboot feature that defaults to the first ESDI MVME323 controller (8), the first ESDI disk drive (0), and the **/stand/sysV68** file. Alternate boot devices are shown in Table 3-1. If no MVME323 is installed, the system next attempts to boot the MVME320B controller (0), the first ST-506 disk drive (0), and the file **/stand/sysv68**.

For example, to boot diagnostics from the optional floppy drive, type **0,2,test134** in response to the "Enter Alternate Boot Device" prompt. The **0** represents the MVME320B controller, **2** is the floppy disk drive, and **test134** is the file to be loaded.

Typing the default values is optional. In the previous example, typing **,2,/test134** has the same effect as **0,2,/test134**.

TABLE 3-1. Boot Device Configurations

CONTROLLER	DRIVE	FILE
ST-506 Hard Disk		
0 = MVME320B (NOTE 1)	0 = ST-506 drive (NOTE 1)	Any file in the SYSTEM V/68 file system partition 0 (directory "/"). */stand/sysV68
Floppy Disk Drive (optional)		
0 = MVME320B	2 = floppy drive	Any file in the SYSTEM V/68 file system partition 0 (directory "/"). */stand/sysV68
Cartridge Tape		
4 = MVME350	0 = cartridge tape drive	Any file in the SYSTEM V/68 file system partition 0 (directory "/"). */stand/sysV68
ESDI Disk Drive		
8 = MVME323 (NOTE 2)	0 = ESDI drive (NOTE 2)	Any file in the SYSTEM V/68 file system partition 0 (directory "/"). */stand/sysV68

NOTES: (1) Second default
(2) First Default

After typing the alternate boot device, the service menu is displayed. Type 1 to continue system start-up. Before booting from the alternate boot device, the controller number, drive number, and filename (if changed) are displayed following the "Testing Complete" message.

3.2.2.3 System Debugger

This feature should be used only by someone familiar with the MVME134Bug and 134Diag facilities.

To go to the system debugger, type 3 in response to the Service Menu. The following prompt is then displayed:

```
134Diag>
```

While in the 134Bug or 134Diag, any error or exception process will cause control to be passed to the Service Menu. Refer to the MVME134BUG 134Bug Debugging Package (MVME134BUG).

To return to the Service Menu, type menu.

3.2.2.4 Initiate a Service Call

Systems with an internal modem installed can communicate with the remote maintenance facility at the Motorola National Technical Support Center (NTSC) where test and diagnosis of system problems can be done. This facility can be used if Extended System Self Test fails. After a system self-test error is displayed, the start-up sequence stops and the Service Menu is displayed.

Before initiating a service call, call the service telephone number provided to you. To initiate a service call, type 4. The following message is displayed:

```
Internal modem test in progress . . . . . TEST PASS
```

The "TEST PASS" message is displayed after the internal modem tests have completed. The testing can take up to two minutes. If the modem tests fail, the remote maintenance facility cannot be used and you should contact the Motorola Field Service Division by telephone. If the modem test passes, the NTSC will provide further directions for initiating a remote service call. The call can be an incoming or outgoing call, with reference to the customer machine. The general sequence of an outgoing service call is shown in the following paragraphs.

The system requests:

```
Enter System ID number:
```

Enter the system ID number, which is provided in the paperwork with the system. The system then displays:

```
Dial Out or Wait for Call In (o/i)
```

If "o" is entered, the system displays:

```
(P) = Pulse Dialing, Default is Tone
(=) = Search for Another Dial Tone
(,) = Wait 2 Seconds
Enter service number:
```

Enter the service telephone number supplied by the service center. The system automatically dials the service center and displays the "Connected" message.

```
Service call in progress - Connected
```

If "i" is selected, the system will display a message indicating that it is waiting for a service call.

If the call is unsuccessful, one of the following messages may be displayed:

NO ABT	(Indicates no answer-back tone detected.)
NO NUMBER STORED	(Phone number was not input by user.)
BUSY	(Number dialed had busy signal.)
NO ANSWER	(Call not answered after five rings.)

Control will then be passed to the Service Menu. Type the number **4** to place the call again after several minutes. If connection still is not made, telephone the Field Service Division/Customer Support.

If a connection is made, the system automatically sends an error log or identifier file. Then a message from the service center will be displayed advising further action. An operator at the service center may request concurrent access to the system by displaying the following message:

```
Concurrent mode? (y/n):
```

In the concurrent mode, the support technicians at the NTSC will be able to run tests and diagnose hardware and some software problems. To stop the concurrent mode, type CONTROL-D.

When the service call has ended, the Service Menu will be displayed again.

3.2.2.5 Display System Test Errors

This feature should be used only by someone familiar with the 134Bug and 134Diag facilities.

To display system test errors, type **5** in response to the Service Menu.

All system self-test errors that have been detected are then displayed in a table format. The table contains the major test category and number of failures within that category. Errors are cleared only at the beginning of the Extended System Self Test sequence or manually from the debugger. Refer to the MVME134BUG 134Bug Debugging Package (MVME134BUG).

After the table is displayed, the Service Menu appears on the screen.

3

3.2.2.6 Dump Memory to Tape

This feature provides a way to dump system memory to a tape. The option is useful for troubleshooting an operating system failure. It should be used by someone who has a technical understanding of the operating system.

Type 6 in response to the Service Menu. A question-and-answer sequence follows, the tape is retensioned, and two files are written to the tape. The memory dump to tape has been completed when the following message appears:

```
Done with tape you may remove it.
```

A copy of the /stand/sysv68 file should always be made when the memory dump to tape will be used to troubleshoot a system failure. The tape cannot be analyzed without the /stand/sysv68 file contents. Refer to cp(1), cpio(1), and tar(1) in the SYSTEM V/68 Release 3 User's Reference Manual or the SYSTEM V/68 Release 3 User's Guide, Section 3, for instructions on copying the /stand/sysv68 file.

3.3 TROUBLESHOOTING

3.3.1 Initial Steps

Some initial steps to take if problems occur are described in Table 3-2.

TABLE 3-2. Troubleshooting Hints

SYMPTOM	POSSIBLE SOLUTION
No power. No sound of fans turning.	Plug in line cord. NOTE: There are no fuses or user-replaceable circuit breakers.
Cannot communicate with system via console.	Console cable must be Motorola DTE to DTE type (Part Number 30-W2849B01) or equivalent cables. Make sure RS-232C cable is plugged into the MVME716 in the bottom RS-232C connector, marked CONSOLE. Make sure the terminal is on-line and has the correct set-up (see below). Try another terminal. Ensure that the console terminal is configured as follows: 9600 baud, full duplex, 8 data bits, 1 stop bit, no parity, XON/XOFF flow control.

TABLE 3-2. Troubleshooting Hints (cont'd)

SYMPTOM	POSSIBLE SOLUTION
	The following RS-232C signals must be used: Pin 1 - CG (chassis ground) Pin 2 - TxD (transmit data) Pin 3 - RxD (receive data) Pin 7 - SG (signal ground) Pin 8 - RCD (carrier detect) Pin 20 - DTR (data terminal ready) Pin 4 - RTS (request to send) (jumper) Pin 5 - CTS (clear to send) (jumper) Pin 6 - DSR (data set ready) (jumper)
System will not boot. (SST message appears on screen).	See if boot drive light comes on. If not, call service. If light comes on, record fault message and then call service.
System powers on but turns itself "off" after a time.	Possible fan failure. Turn power switch off, wait 30 seconds. Turn power on while verifying that fans spin normally before shutdown. Possible power supply failure.
System will not access floppy disk.	Check cabling at MVME320B and at the disk drive. Verify correct jumper settings for the MVME320B card.
System hangs after initial boot.	Ensure that the console terminal is using the proper RS-232C configuration. Verify that the backplane VMEbus IACK and bus grant jumpers are installed in empty slots.
System will not access streaming tape unit.	Check for loose cable between the cartridge tape unit and MVME350 module.
No communication with expansion ports.	Ensure that the 60-pin ribbon cable is connected between the transition module and the P2 connector of the communications controller module. Verify the jumper settings of the modules. Check the terminal configuration.

3.3.2 Hard Disk Imperfections

As in any system, there are times when the user will encounter an I/O error when accessing the disk. The error can be one of many; however, the error that is most difficult to diagnose and repair is the error that occurs when trying to read or write to a spot on the disk that is bad. Procedures for dynamically redirecting bad tracks are given in Chapter 4 of the SYSTEM V/68 Release 3 System Administrator's Guide.

3

3.4 OVERVIEW OF SYSTEM PROCEDURES

Procedures for performing administrative tasks under SYSTEM V/68 Release 3 are provided in the SYSTEM V/68 Release 3 System Administrator's Guide. Both step-by-step directions and background information are included. This section points to procedures and provides examples and system-specific information for common system and administrative tasks.

3.4.1 Start-Up Procedures

3.4.1.1 Software Installation

Instructions for installing software are contained in the Software Release Guide for SYSTEM V/68 Release 3.

3.4.1.2 Command Sequence

In SYSTEM V/68, commands have the following structure:

command argument argument argument ...

White space is used to delimit command names and arguments. A carriage return (CR) enters the command. Arguments that contain spaces or tabs should be enclosed with double quotes.

3.4.1.3 Logging On as Root

Root is a very powerful user, appropriately called the "superuser." The superuser is the only user who may perform all the system maintenance tasks. Because the superuser, or root, is the only user with access permission for everything on the operating system, whoever is logged on as root can read, change, or remove anything on the system.

The powers of the superuser should be reserved for a limited number of users, perhaps solely for the system administrator. (Refer to the SYSTEM V/68 Release 3 System Administrator's Guide for more information about the role of the system administrator.) This may be accomplished by giving root a password known only to those users to whom superuser powers are given.

Logging on is the process of identifying yourself to the system. To log on as root, type:

```
Console Login: root
```

The system then will ask for a password. If this is the first time anyone has logged on as root, a password for root must be assigned. In the as-shipped Model 2334, the password assigned is the carriage return character (<RETURN>).

3.4.1.4 System Administration Menu Package

Most system administration procedures can be performed using the System Administration Menu package. This package is a hierarchical structure of interactive screens for performing administrative tasks. The menu interface is described in the Introduction and Appendix D of the SYSTEM V/68 Release 3 System Administrator's Guide and also on the SYSTEM V/68 Release 3 User's Reference Manual pages for **sysadm**(1). The System Administrator's Guide information includes a reference guide for tasks and **sysadm** commands.

If the **sysadm** command is given without an argument, the following menu is displayed:

```
                        SYSTEM ADMINISTRATION

  1  diagnostics     system diagnostics menu (not SSID)
  2  diskmgmt        disk management menu
  3  filemgmt        file management menu
  4  machinemgmt     machine management menu
  5  packagemgmt     package management menu
  6  softwaremgmt    software management menu
  7  syssetup        system setup menu
  8  ttymgmt         tty management menu
  9  usermgmt        user management menu

  Enter a number, a name, the initial part of a name, or
  ? or <number>? for HELP, q to QUIT:
```

To access one of the submenus shown in the display, enter the menu item number, the menu name, or the initial part of the menu name, followed by a carriage return. For example, to install a new software package, type one of the following:

6 <RETURN>

softwaremgmt <RETURN>

software <RETURN>

If the **sysadm** command is given with an argument, the named sub-command or sub-menu is accessed directly without going through the top menu. For example, the command

sysadm chgpassword

can be used to change a user password without stepping through the System Adminstration Menu and moduser sub-menu.

Experienced users and administrators of SYSTEM V/68 are familiar with commands and command sequences for performing many of the tasks included in the System Administration Menu package. These commands and procedures can still be used by the superuser and in many cases are shown as part of the procedures described in "Part 1: Procedures" in the SYSTEM V/68 Release 3 System Administrator's Guide. In the procedures described in this section, the individual superuser commands are given as alternate methods, where applicable.

System Setup

The "System Setup" sub-menu provides routines for describing the system environment, including:

- Setting the date and time
- Establishing system passwords
- Assigning or changing the machine nodename
- Recovering a forgotten root password

Refer to Procedures 1.1 through 1.5 in the SYSTEM V/68 Release 3 System Administrator's Guide.

Administrative and System Passwords

The use of special system logins and administrative commands provides a good balance of system use and system security. Refer to Procedure 1.4 and Chapter 1 of the SYSTEM V/68 Release 3 System Administrator's Guide. It is recommended that passwords be assigned to the commands and logins listed in Table 3-3.

TABLE 3-3. Administrative and System Logins

ADMINISTRATIVE LOGINS	SYSTEM LOGINS
br	root
setup	sys
sysadm	bin
powerdown	adm
checkfsys	uucp
makefsys	nuucp
mountfsys	rje
umountfsys	daemon
	trouble
	lp

Creating User Accounts

The "User Management" sub-menu can be used to identify new users or groups of users to the system (refer to Procedure 2.1 in the SYSTEM V/68 Release 3 System Administrator's Guide). The sub-commands **adduser** and **addgroup** lead the administrator through the steps that make necessary changes to the files **/etc/passwd** and **/etc/group**.

The **adduser** sub-menu also offers the capability to establish a user directory, assign a user password, delete users or groups, modify user and group information, and write to all users. Refer to Procedures 2.2 through 2.5 and Chapter 2 the SYSTEM V/68 Release 3 System Administrator's Guide.

These tasks can also be accomplished by manually editing the files **/etc/passwd** and **/etc/group**. The formats of these files are given on SYSTEM V/68 Release 3 Programmer's Reference Manual pages **passwd(4)** and **group(4)**.

3.4.1.5 Logging in as an Ordinary User

To log in, type:

Console Login: *logname*

The system will then ask for a password if one has not already been assigned. The system will respond with a **$** prompt. Remember that **$** is the default prompt for normal users; # is the root, or superuser, prompt. If you have any doubts about whether you are logged in as yourself or as root, you should be able to tell immediately by which system prompt appears on the screen. You can also use the **id(1)** command, which displays your user ID and group ID.

If the system administrator has not used the **sysadm adduser** command to assign a password to your login ID, you may use the **passwd** command (refer to **passwd(1)**). The next time you log in to the system, you will enter this password in response to the login prompts:

```
Console Login:
Password:
```

If either the login name or the password is typed incorrectly, another "Login:" prompt will be displayed. For more information on logging in, refer to Chapter 2 in the SYSTEM V/68 Release 3 User's Guide.

3.4.1.6 Using the .profile File

When you log in, the system looks for a file named **.profile** in your home directory to set up the environment and terminal variables. If you want information about some of the variables that have been set, use the **env(1)** command.

```
$ env
```

The terminal will display several lines of information in the form *name=value*, where *name* is a variable and *value* is the current assignment for that variable.

When user accounts are created, the standard **.profile** that is shipped with the system can be copied to the user's home directory. This can be done by the user with the command:

```
$ cp /etc/stdprofile /u/logname/.profile
```

where */u/logname* is the name of the user's home directory. Do not perform this command as root because the group and owner of the new **.profile** will be root. Lines in the file **.profile** that begin with the # character will be read as comments. Use the text editor to remove the # character at the beginning of lines in the **.profile** that should not be read as comments.

Now log off the system, using either

```
$ exit
```

or CONTROL-D, and then log back on so that the **.profile** is invoked. Chapter 7 in the SYSTEM V/68 Release 3 User's Guide gives details on modifying the **.profile** file.

A sample **.profile** is shown in Figure 3-1.

```
LOGNAME=root
MAIL=/usr/mail/root
mailcheck=600
PATH=:/bin:/etc:/usr/bin:/mot/bin
stty erase
stty kill
stty echoe echok ixon ixoff -tabs
TERM=vt100
PS1=#
PS2=>
TZ=MST7
export LOGNAME MAIL MAILCHECK PATH
export TERM PS1 PS2 TZ
```

FIGURE 3-1. Sample **.profile**

3.4.1.7 Shutting Down the System

It is extremely important to use the correct procedure to shut down the system. Do not panic and use the RESET button or the ON/OFF system power switch, and do not pull the electrical plug to stop the system. If you feel you have made a mistake, this will only compound the problem.

Only the superuser may shut down the system. If you are logged on as a user, log off this account and log back on as **root**. When you see the root prompt (#), type:

```
# shutdown -y -gn -is
```

where *n* is the number of seconds that will elapse from the time users are notified to the time the system is shut down (default is 60 seconds). The **-i** option specifies the state **init**(1M) is to have, in this case single-user state or level 1. This specification causes the system to unmount everything and terminate all currently running processes (other than the system console). The superuser is asked whether a special message is to be used to broadcast the shutdown to users. Users are informed how many seconds will elapse before shutdown. The **shutdown**(1M) program then kills all active processes, unmounts file systems, and updates the file system superblocks (by means of the **sync**(1) command). The message **Wait for INIT SINGLE USER MODE before halting** then appears on the screen. When the message **INIT SINGLE USER MODE** appears, type:

```
# sync
# sync
# sync
```

and wait for 30 seconds after the root prompt (#) is displayed. The RESET or ON/OFF switch can then be used to halt the system. For a more detailed explanation of the **shutdown** command and its options, refer to the manual page **shutdown**(1M) and Chapter 3, "Processor Operations," in the SYSTEM V/68 Release 3 System Administrator's Guide.

3.4.1.8 Changing Operating Level

When tasks such as software installation, file backup and restore, hard disk formatting, and system reconfiguration are performed, the system administrator may need to take the system to single-user mode. Using the root login, the system can be taken from multi-user mode (run state 2) to single-user mode via the **shutdown** command.

```
# shutdown -y -is
```

To return to multi-user mode after administrative tasks have been completed, use the following command.

```
# init 2
```

For additional information about operating levels, refer to Chapter 3, "Processor Operations," in the SYSTEM V/68 Release 3 System Administrator's Guide.

3.4.2 Backup and Restore Procedures

Backup and restore can be invoked either directly from the shell with the command

br

or from the the **sysadm** program (refer to **sysadm**(1M) and to Procedure 5.4 in the SYSTEM V/68 Release 3 System Administrator's Guide).

Before implementing backup and restore procedures, the following steps should be taken:

(1) Examine the PREFERENCES menu (item 6 in the **backup_restore** main menu) to set up the routine backup procedures to meet your requirements.

(2) Edit the description file **/backups/files/DiskInfo** to include every file system and every partition on every disk in the system. The initial contents of this ordinary text file describe a minimum system as it arrives from the factory. It should be edited every time a file system is added, changed, or removed from this initial configuration.

(3) Select an archive device.

3.4.3 Reconfiguration Procedures

The Model 2334 system is set to a basic configuration that is satisfactory for most applications. It may be reconfigured to enhance the performance for a particular application or to add new memory and peripherals. Procedure 6.1 in the SYSTEM V/68 Release 3 Administrator's Guide gives steps for rebuilding the operating system.

3.4.3.1 System Variables

Tunable system parameters are listed in Chapter 6 of the SYSTEM V/68 Release 3 System Administrator's Guide. Values for kernel parameters, paging parameters, STREAMS parameters, and interprocess parameters are given for systems with different sizes of RAM. Use the **/etc/sysdef** command to list the current values of the tunable parameters in the present configuration of your system. The parameters are defined using the **sysgen**(1M) utility.

3.4.3.2 Hardware Changes

The interactive **sysgen**(1M) command is used to incorporate changes to the system. Modules known to the system can be added to or deleted from the configuration and values for parameters such as "Number of Devices" can be altered. To make new hardware devices known to the system, use the **mknod**(1M) command. Chapter 4 of this document contains configuration information (e.g., memory addresses) for VMEmodules that may be used in the Model 2334.

3.4.3.3 Making File Systems

For a disk that has a slice table on it, **sledit(1M)** can be used to make filesystems. Otherwise, the **mkfs(1M)** utility can be used to create file systems on a device, as shown in the following example:

```
mkfs /dev/rdsk/m320_1s1 28032:3200 8 128
```

The **mkfs** command writes on the *special* file (in this case **/dev/rdsk/m320_1s1**) using the values found in the remaining arguments on the command line. The second argument (**28032:3200**) specifies the size of the file system; i.e., the number of 512-byte blocks the file system will occupy. If the number of i-nodes is not given, the default is the number of logical blocks (1024) divided by 4 (the size of a logical block is determined by the command name: **omkfs**=512 bytes, **mkfs**=1024 bytes, **mkfs8k**=8192 bytes).

NOTE

The physical disk block size is 512 bytes. All utilities that report block counts report in 512-byte units (e.g., **df, du, ls, fsck, cpio**). The logical block size is used to determine the number of i-nodes and by the **fsck(1M)** program when it reports problems accessing a file system block.

The last two arguments on the **mkfs** command line are the *rotational gap* and the *blocks/cylinder*. The values for these variables in Model 2334 drives are given in the SYSTEM V/68 Release 3 System Administrator's Guide.

3.4.4 Disk Partitioning Procedures

The Model 2334 basic configuration includes either a Winchester hard disk (with MVME320B controller) or an Enhanced Small Device Interface (ESDI) hard disk (with MVME323 controller). Refer to paragraph 4.1.1 for descriptions of basic configurations. For both drives, there are eight slices possible per drive (0 through 7). Each slice begins at some offset and extends for a certain number of blocks, see **sledit(1M)**. By convention, slice 7 refers to the entire disk, beginning at physical block 0 (a physical block is 512 blocks).

CAUTION

SLICE 7 SHOULD NOT BE USED FOR ANY PURPOSE OTHER THAN FORMATTING, INITIALIZING TRACK REDIRECTION, OR INSTALLING THE DISK-BASED BOOTLOADER (REFER TO dinit(1M)).

On all drive types, there is an area between the beginning of the disk and the beginning of slice 0. The area is used by the firmware bootloader, **dinit(1M)**, the disk formatting utility, the kernel, and diagnostic tests. It contains drive configuration information, alternate track redirection tables, and the disk-based bootloader.

Slicing definitions are contained in format files in the directory **/usr/include/sys/io**.

Specifications and partitioning procedures for each drive type are provided in Appendix A of the System Administrator's Guide.

CHAPTER 4 - SYSTEM HARDWARE OVERVIEW

This chapter describes hardware configurations and individual components of the Model 2334. Detailed information about the modules is contained in the user's manuals listed in the "Documentation Roadmap" paragraph of Chapter 1.

A summary of board addresses, interrupt levels, bus request levels, and bus grant levels is provided in Table 4-18. Memory module addresses are listed in Table 4-21. Physical specifications for system components are given in Appendix A.

4.1 HARDWARE COMPONENT CONFIGURATIONS

4.1.1 Basic Configurations

There are four basic configurations for the Model 2334: two combinations of components, each of which is available in a 110V or 220V version. Each configuration includes the following general components:

- system enclosure
- processor and memory
- mass storage devices

NOTE

The configurations shown in the following paragraphs are offered for user convenience. A user could begin with a 6-slot enclosure and an MVME134F-3 processor and build a system using the modules shown in Tables 4-1, 4-2, and 4-3.

4.1.1.1 Model 2334 Configuration 1

Configuration 1 (SYS2334NY011) includes the following components. VMEmodules in this configuration occupy 3 slots in the VME backplane.

- MVME953-1 enclosure with 110V power supply or MVME953-2 enclosure with 220V power supply
- MVME134F-3 Processor (1 slot)
- MVME716-3 Serial Port Distribution Module
- MVME320F-3 Winchester and floppy disk controller module (1 slot)
- MVME841F-3 67Mb (formatted) Winchester ST-506 disk drive
- MVME851F-3 60Mb Streaming Tape Drive & MVME350 Controller (1 slot)

4.1.1.2 Model 2334 Configuration 2

Configuration 2 (SYS2334NY021) includes the following components. VMEmodules in this configuration occupy 3 slots in the VME backplane.

- MVME953-1 enclosure with 110V power supply or MVME953-2-3 enclosure with 220V power supply
- MVME134F-3 Processor (1 slot)
- MVME716-3 Serial Port Distribution Module
- MVME323F-3 ESDI Disk Controller (1 slot)
- MVME842F-3 160Mb ESDI Winchester Disk Drive
- MVME851F-3 60Mb Streaming Tape Drive & MVME350 Controller (1 slot)

4

4.1.2 VMEmodules, Disk and Tape Drives, Transition Modules, and Modem

VMEmodules that use the VMEbus backplane in the Model 2334 are listed in Table 4-1. The table lists the number of slots required for each module and the maximum number that can be used in the system. Module placement in the 6-slot enclosure is described in paragraph 4.4.

NOTE: Installation information (kit instructions) for components ordered separately is packed with the component.

TABLE 4-1. VMEmodule Components

PART NUMBER	DESCRIPTION	VME SLOTS USED	MAXIMUM IN SYSTEM
MVME350F-3	Cartridge Tape Controller	1	1
MVME323F-3	ESDI Disk Controller	1	1
MVME332FXT-3 (NOTE 1)	8-port Serial/Parallel Controller	1	1
MVME333F-3	Intelligent Communications Controller for SNA or BSC	1	1
MVME335F-3 (NOTE 1)	Serial and Parallel I/O Module	1	1
MVME330F-A-3	OFFICELAN Ethernet LAN Controller	1	1
MVME330F-B-3	RFS Ethernet LAN Controller	1	1
MVME320BF-3	Winchester/Floppy Disk Controller	1	1

NOTE: (1) It is not recommended that an MVME332FXT module and MVME335 module be used in the same system.

Disk and tape drives that can be configured in the Model 2334 are listed in Table 4-2. Drive positions in the enclosure are provided in paragraph 4.5. Cabling information is given in Appendix D.

TABLE 4-2. Disk and Tape Drives

PART NUMBER	DESCRIPTION	PERIPHERAL SLOTS USED	MAXIMUM IN SYSTEM
MVME831F-3	1.2Mb Floppy Disk Drive	1 half-height	1
MVME841F-3	67Mb Winchester Disk Drive	2 half-height	1
MVME842F-3	160Mb ESDI Winchester Disk Drive	2 half-height	1
MVME851F-3	60Mb Streaming Tape Drive	2 half-height	1

Transition boards and internal modem for the Model 2334 are listed in Table 4-3. These components do not use VME backplane slots.

TABLE 4-3. Transition Boards and Internal Modem

PART NUMBER	DESCRIPTION	ASSOCIATED MODULE
MVME332FPA1	Single Parallel Port	MVME332FXT
MVME332FPA2	Dual Parallel Port	MVME332FXT
MVME710-3	Serial Port Transition Board	MVME332FXT
MVME710F-3	Remote Service Modem	None; connect to MVME716
MVME715P-3	Serial Port Transition Board	MVME335F
MVME716-3	Serial Port Transition Board	MVME134F-3

4.2 COMPONENT DESCRIPTIONS

The paragraphs in this section provide information about the basic and optional components of the Model 2334. A functional description, jumper header locations, and jumper settings for SYSTEM V/68 are given for each component.

4.2.1 MVME134F-3 Processor

4.2.1.1 General Description

The MVME134F-3 is an advanced VMEbus compatible microcomputer. The module can have 32-bit address and data computing capability, provided by the MC68020 microprocessor.

The MVME134F-3 requires one slot in the 2334 system. The module has 4Mb onboard DRAM, 256Kb ROM/PROM/EPROM/EEPROM, Paged Memory Management Unit (PMMU), and Floating Point Co-Processor (FPCP). It also has battery backup SRAM with VMEbus interface with system controller functions. In addition to the major features, the MVME134F-3 provides three programmable timers and watchdog functions, RS-232 debug port and two multiprotocol (synchronous/ asynchronous) serial ports.

As system controller, the MVME134F-3 provides the following system management and control functions:

- VMEbus arbitration -- The system controller accepts bus requests from bus masters on one bus request priority level and issues a bus grant.
- System clock -- A 16.0 MHz clock signal is provided to other VMEbus devices for counting and synchronizing tasks.
- Reset -- Upon power on (unplugging the AC input or operating AC power switch), the MVME134F-3 will drive the reset line on the VMEbus.
- Bus time-out -- The MVME134F-3 will generate a Bus Error (BERR) signal when a non-existent device is addressed on the VMEbus. Time-out is selectable for 32, 64, 128 microseconds, or infinity.

The MVME134F-3 includes the MC68881 FPCP. The serial ports on the MVME134F-3 is cabled to the MVME716 via the 26-pin connector located on the front panel of the module and the 96 pin ribbon cable from the P2 connector.

Space and power requirements are listed in Appendix A.

4.2.1.2 Jumper Header Locations

Header locations on the MVME134F-3 are shown in Figure 4-1. These locations apply for all the configurations listed in paragraph 4.1.

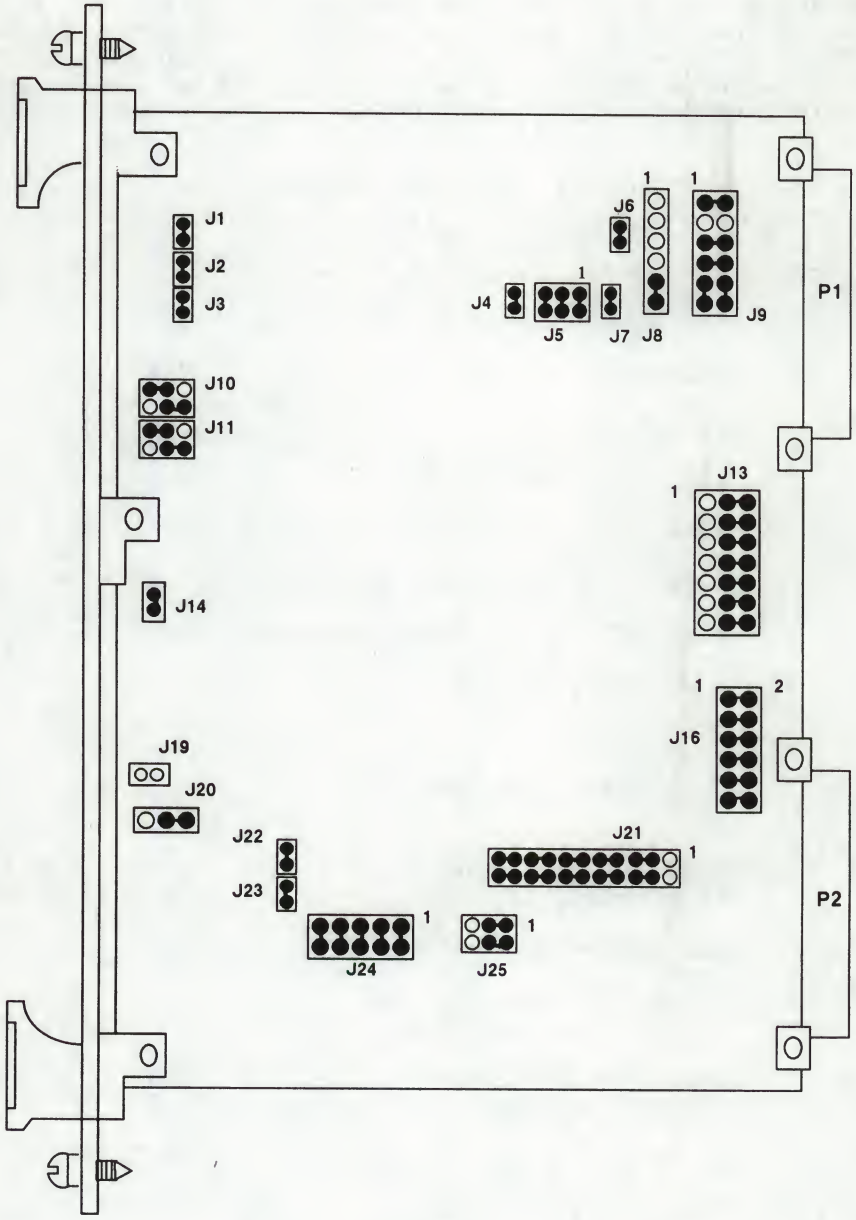


FIGURE 4-1. MVME134F-3 Jumper Header Locations

4.2.1.3 **SYSTEM V/68 Configuration**

The jumpers on the MVME134F-3 module are set as shown in Table 4-4. Jumper settings at location J8 and J9 are configured for bus grant level 3. Jumper settings at location J21 control the configuration of Port B. In the model 2334, J21 is configured for DTE (terminal) when using Motorola DTE to DTE cable (part number 30-W2849B01). In the model 2334, the Bus Error Interrupt is disabled (no jumper on J19) on the MVME134F-3.

TABLE 4-4. MVME134F-3 Jumper Settings

HEADER	DESCRIPTION	SETTING
J1	Abort Switch Enabled	1-2
J2	Watchdog Reset Enabled	1-2
J3	RMW Cycle Enabled	1-2
J4	System Controller Enabled	1-2
J5	VMEbus Interrupter Disabled	1-2,3-4,5-6
J6	24 and 32-bit Address Size Selected	1-2
J7	Onboard DRAM 24 and 32-bit Addressing	1-2
J8	Level 3 VMEbus request	5-6
J9		1-2,5-6,7-8 9-11,10-12
J10	2 64K x 8 ROM/PROM/EPROM	2-4,3-5
J11		2-4,3-5
J13	VMEbus Request Disabled IRQ1* through IRQ7* Enabled	2-3,5-6,8-9,11-12 14-15,17-18,20-21
J14	Reset Switch Enabled	1-2
J16	Onboard DRAM Offset Address is $00000000 on the VMEbus	1-2,3-4,5-6 7-8,9-10,11-12
J17	Onboard 4Mb DRAM Using	2-3
J18	1 Megabit x 1 chips	2-3
J19	Bus Error Interrupt Disabled	No Jumper
J20	VMEbus Data Width Select	1-2

TABLE 4-4. MVME134F-3 Jumper Settings (cont'd)

HEADER	DESCRIPTION	SETTING
J21	Serial Port B Configured as DTE	3-5,4-6,7-9,8-10 11-13,12-14,15-17 16-18,19-21,20-22
J22	Local Time-out Enabled	1-2
J23	Global Time-out Enabled	1-2
J24	MSR bits 0-4 all=0	1-2,3-4,5-6,7-8 9-10
J25	RTXCA and RTXCB Driven by 1.230769 MHz signal	1-3,2-4

4.2.2 MVME320B Winchester/Floppy Disk Controller

4.2.2.1 General Description

The MVME320B module provides the traditional and advanced features required to control hard disk drives and floppy disk drives. It can control up to four disk drives (up to two hard disk drives or up to four floppy disk drives) in many combinations. It supports single-density and double-density (FM and MFM) recordings on floppy disk drives and double-density (MFM) recording on hard disk drives. The MVME320B performs VMEbus DMA over a 16-bit data path and is capable of handling serial data rates up to five megabits/second.

The host system communicates with the MVME320B through Event Control Areas (ECAs) which reside in system memory. An ECA parameter block is set up for each disk drive to be controlled. These areas contain information required by the MVME320B to execute disk commands, including data about the requested command and the disk drive. DMA operations are defined by the ECA description of the command.

The MVME320B contains seven internal 8-bit registers. The host system requests an operation using these registers. Registers 1, 3, 5, and 7 are loaded with the 24-bit address of the pointer to the ECA parameter block to be acted upon. Command execution does not start until drive availability is determined. The MVME320B microprogram uses the data contained in the ECA block to generate disk interface signals and perform the requested drive I/O. Data transfers to and from floppy disks are executed in real time (with 2-byte buffering). Data transfers to and from Winchester drives are buffered on a sector basis.

Space and power requirements are listed in Appendix A.

The four connectors for disk drives are shown in Figure 4-2. Connector J3 is a 50-pin header-type that connects drives in a daisy-chain configuration. This connector carries control information only for the hard disk drives. Connector J4 is used to connect 5-1/4 inch floppy drives in daisy-chain configuration. Connectors J1 and J2 are 20-pin header-type connectors used to radially connect data lines from the hard disks to the controller. Refer to paragraph 4.5 for information about disk drive configuration and drive compatibilities. Refer to Appendix D for cabling information and examples.

4.2.2.2 Jumper Header Locations

Header locations on the MVME320B are shown in Figure 4-2.

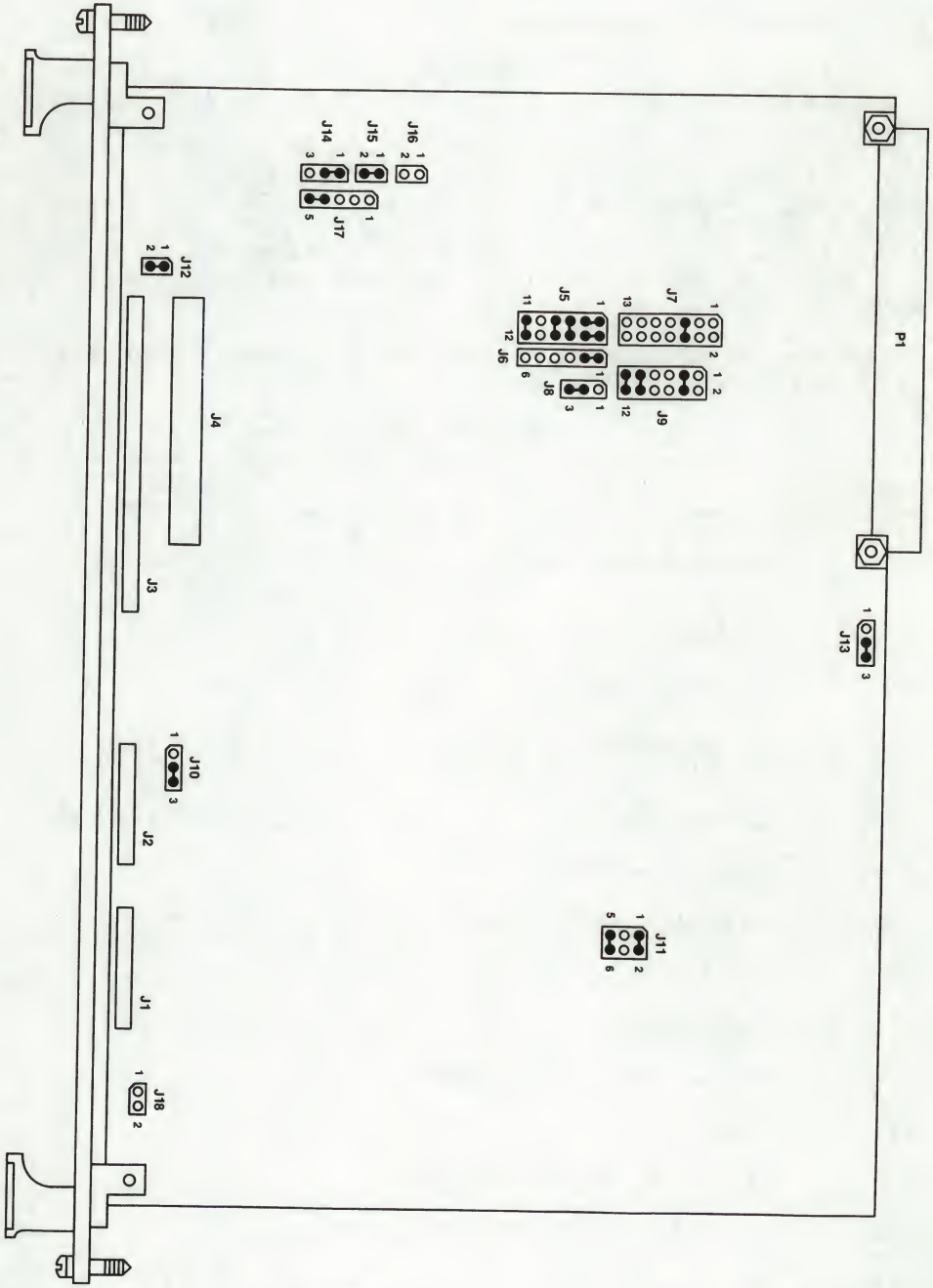


FIGURE 4-2. MVME320B Jumper Header Locations

4.2.2.3 SYSTEM V/68 Configuration

Jumper settings for the MVME320B in a Model 2334 are shown in Table 4-5. Bus grant and bus request levels are set at 3 (J5, J6) and the interrupt level is set at 5 (J7, J11). The address modifier select (J8) is jumpered to select user or supervisor access. The MVME320B uses a 16 MHz onboard clock, selected at J13. The floppy tape enable is set for no floppy tape (J10) and 4K ROM is selected (J14). Jumpers at J9 select an address of FFFFB000. To use 5-1/4 inch dual-density floppy drives in the high-density (1.6Mb, unformatted) mode, the following jumpers are set: jumpers at J17 are installed to connect the DENSITY signal to the J4 connector; a jumper is installed at J15 to connect the READY line.

For a summary of board addresses, interrupt levels, bus request levels, and bus grant levels, refer to Table 4-18.

TABLE 4-5. MVME320B Jumper Settings

HEADER	DESCRIPTION	SETTING
J5	Bus Grant Level Select	1-3,2-4,5-6,7-8, 11-12
J6	Bus Request Level Select	1-2
J7	Interrupt Request Level Select	5-6
J8	Address Modifier Select (User or Supervisor Access)	2-3
J9	Address Decode	3-4,9-10,11-12
J10	Floppy Tape Enable	2-3
J11	Interrupt Acknowledge Level	1-2,5-6
J12	PROM Enable	1-2
J13	Clock Select	2-3
J14	PROM Size Select (4K or 8K)	1-2
J15	READY Line	1-2
J16	J4-4 Option (In Use/Head Load)	No Jumper
J17	J4-2 Option (Spare/Density)	4-5
J18	Density Mode	No Jumper

4.2.3 MVME323 ESDI Disk Controller

4.2.3.1 General Description

The MVME323 is a high-performance 5-1/4 inch disk drive controller that will accommodate up to four ESDI disk drives. The MVME323 can handle disk drive transfer rates of up to 20 megabits per second. The MVME134F-3 System Self Test (SST) must be revision 1.051 or higher to support ESDI drives.

4.2.3.2 Jumper Header Locations

Header locations on the MVME323 are shown in Figure 4-3.

4.2.3.3 SYSTEM V/68 Configuration

Jumper and switch settings for the MVME323 in the Model 2334 are shown in Table 4-6. Jumpers at locations JA1, JA2, and JA3 are used as a block to select bus request level 3. The eight-switch S1 DIP switch is set to select base address A000.

TABLE 4-6. MVME323 Jumper and Switch Settings

LOCATION	DESCRIPTION	SETTING
JA5 JA6 JA7	Bus Request Level Select	JA5-7 to JA5-8 JA6-7 to JA6-8 JA6-2 to JA7-1 JA6-4 to JA7-3 JA6-6 to JA7-5 JA7-7 to JA7-8
JA2	Factory Setting	1-2
JA3	Factory Setting	1-2
JA4	Factory Setting	2-3
JA1	Factory Setting	1-2
Switch S1	Base Address Selection	S1-8 ON S1-7 OFF S1-6 ON S1-5 OFF S1-4 ON S1-3 ON S1-2 ON S1-1 ON

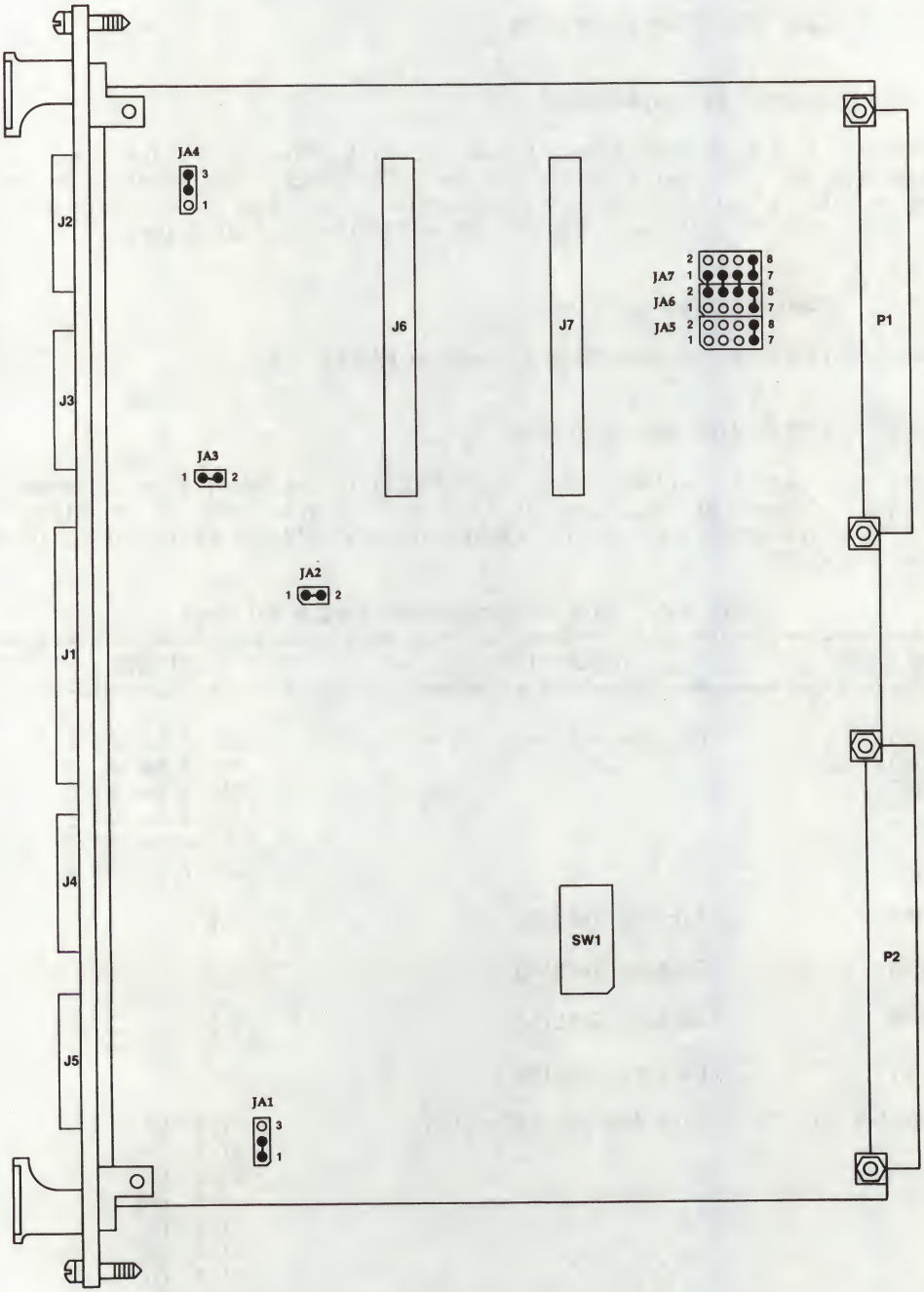


FIGURE 4-3. MVME323 Jumper Header Locations

4.2.4 MVME350 Streaming Tape Controller

4.2.4.1 General Description

The MVME350 is an Intelligent Peripheral Controller (IPC) designed to interface with either 24-bit address VMEmodules (P1 only) or extended address (32-bit) VMEmodules (P1 and P2).

An IPC VMEbus Control and Status Register (VCSR) space is provided for another VMEbus master to control the IPC initialization and operation. This shared area is 32 bytes deep and may be mapped on any 256-byte boundary in the 64K VMEbus Short I/O space via the 8-position switch S1. Functions that are provided include: registers for passing addresses and address modifiers, a Test and Set (TAS) bit for CSR control, a reset (RST) bit for holding the IPC in reset, and an attention (ATN) bit for causing an interrupt to the IPC microprocessor.

QIC-02 is an intelligent interface for streaming tape drives. The QIC-02 interface is made through a 50-pin ribbon connector at J2 (front) or at P2 (rear). The interface has an 8-bit wide bidirectional data bus for moving both commands/status and data. There are eight control lines, four from the tape drive to the host and four from the host to the tape drive.

Space and power requirements are listed in Appendix A.

4.2.4.2 Jumper Header Locations

Header locations on the MVME350 are shown in Figure 4-4.

4.2.4.3 SYSTEM V/68 Configuration

One eight-position DIP switch is located on the MVME350 module. This switch is used to select the VMEbus mapping boundary for the MVME350 Control and Status Register. The switch will map the MVME350 to any 256-byte boundary in the Short I/O space, $FFv‘00. The base address selected in the Model 2334 is $FFFF5000, as shown by the following S1 settings.

S1-1 ON
S1-2 ON
S1-3 ON
S1-4 ON
S1-5 OFF
S1-6 ON
S1-7 OFF
S1-8 ON

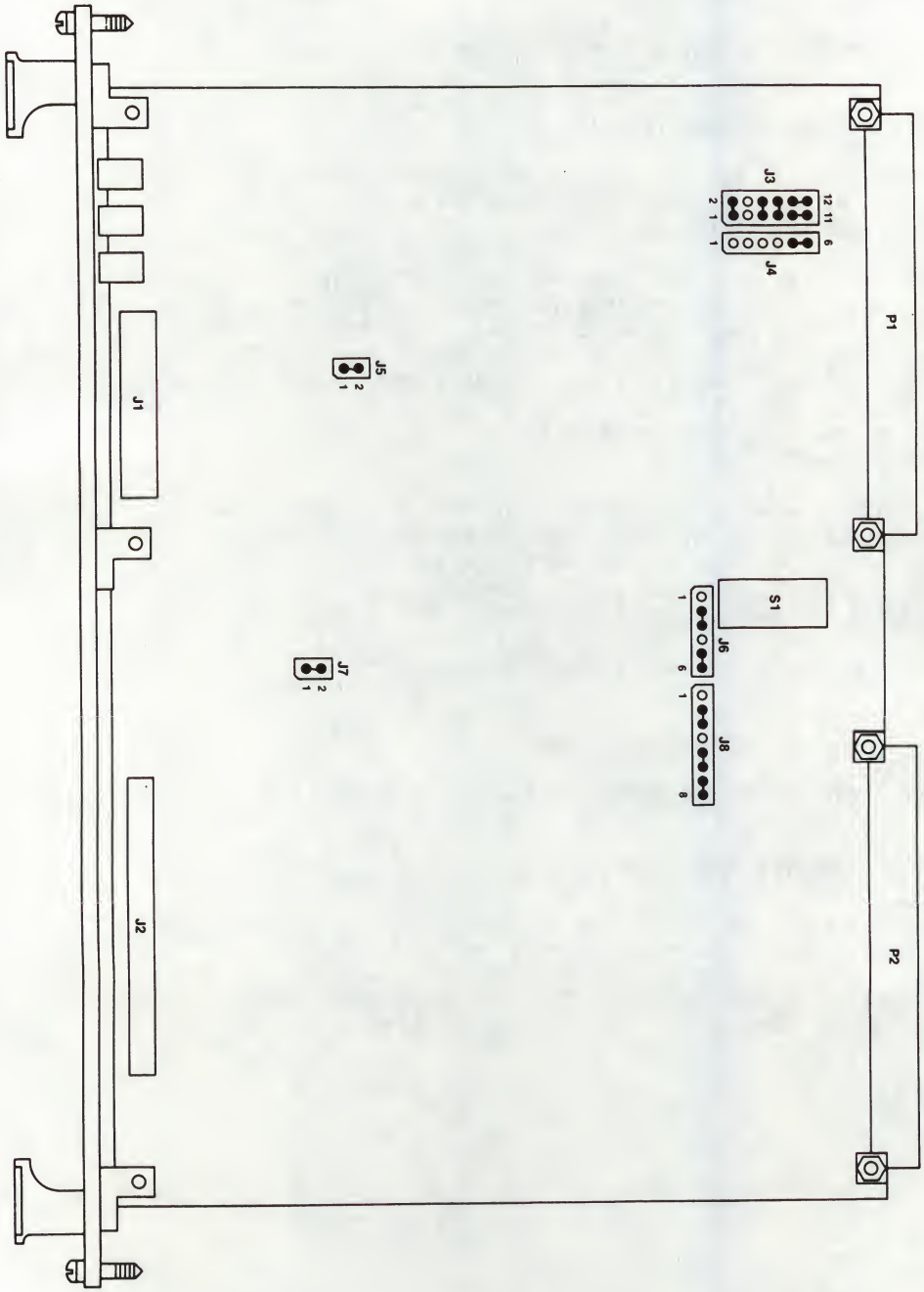


FIGURE 4-4. MVME350 Jumper Header Locations

Jumper settings for the MVME350 in the Model 2334 are shown in Table 4-7. Bus grant (J3) and bus request (J4) are set for level 3. All other jumper settings are the default factory configuration.

TABLE 4-7. MVME350 Jumper Settings

HEADER	DESCRIPTION	SETTING
J3	VMEbus Grant Level	1-2,5-6,7-8,9-11, 10-12
J4	VMEbus Request Level	5-6
J5	10 MHz Clock to PI/T Enable	1-2
J6	RAM Size Selection	2-3,5-6
J7	DTACK Enable	1-2
J8	ROM Size Selection	2-3,5-6,7-8

For a summary of board addresses, interrupt levels, bus request levels, and bus grant levels, refer to Table 4-18.

4.2.5 MVME332XT Intelligent Communications Controller

4.2.5.1 General Description

The MVME332XT Intelligent Communications Controller (ICC) is a double-high VMEmodule that provides an intelligent avenue to serial and printer I/O. The MVME332XT has eight asynchronous serial I/O channels that support up to 38.4 Kbaud, full-duplex operation with either hardware or software handshaking. All the ports are RS-232C compatible. Modem and terminal interface selection is made via jumper arrays on the MVME710 Eight Channel Serial I/O Distribution Module. The MVME332XT supports one Centronics-compatible parallel printer port, accessible via a shielded front panel mounted connector.

The MVME332XT firmware supports output character processing for line printer I/O. The firmware executes from no wait state 512K EPROMs. Character buffering routines utilize no wait state 196Kb local and 64Kb dual-ported RAM spaces for high performance. Three LED indicators (HALT, RUN, FAIL) are located on the front panel of the MVME332XT.

Space and power requirements are listed in Appendix A.

4.2.5.2 Jumper Header Locations

Header locations on the MVME332XT are listed in Figure 4-5.

4.2.5.3 SYSTEM V/68 Configuration

Jumper settings for the MVME332XT in the Model 2334 are listed in Table 4-8. The bus request/grant level is set for the level 3 (J1). Jumpers at location J4 are set to select 64K x 8 ROMs/EPROMs used at sockets U57 and U60.

For a summary of board addresses, interrupt levels, bus request levels, and bus grant levels, refer to Table 4-18.

TABLE 4-8. MVME332XT Jumper Settings

HEADER	DESCRIPTION	SETTING
J1	VMEbus Grant/Request Priority Level	1-2,5-6,7-8, 9-11,10-12,16-18
J4	ROM/EPROM Size Selection (64K x 8 devices)	1-2

The MVME332XT has two onboard DIP switches, located as shown in Figure 4-5. Switch S2 is used to select the firmware mode. The four switch positions should be set as follows:

S2-1 OFF
S2-2 OFF
S2-3 ON
S2-4 ON

Switch S1 is an 8-position switch used to select the VMEbus base address. Base address assignments and associated switch settings are listed in Table 4-9.

TABLE 4-9. MVME332XT Switch S1 Settings for Base Address

S1 Switch Positions								BASE
1	2	3	4	5	6	7	8	ADDRESS
ON	OFF	OFF	OFF	OFF	ON	ON	ON	ff780000
ON	OFF	OFF	OFF	OFF	ON	ON	OFF	ff790000
ON	OFF	OFF	OFF	OFF	ON	OFF	ON	ff7a0000
ON	OFF	OFF	OFF	OFF	ON	OFF	OFF	ff7b0000
ON	OFF	OFF	OFF	OFF	OFF	ON	ON	ff7c0000
ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ff7d0000
ON	OFF	OFF	OFF	OFF	OFF	OFF	ON	ff7e0000
ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ff7f0000

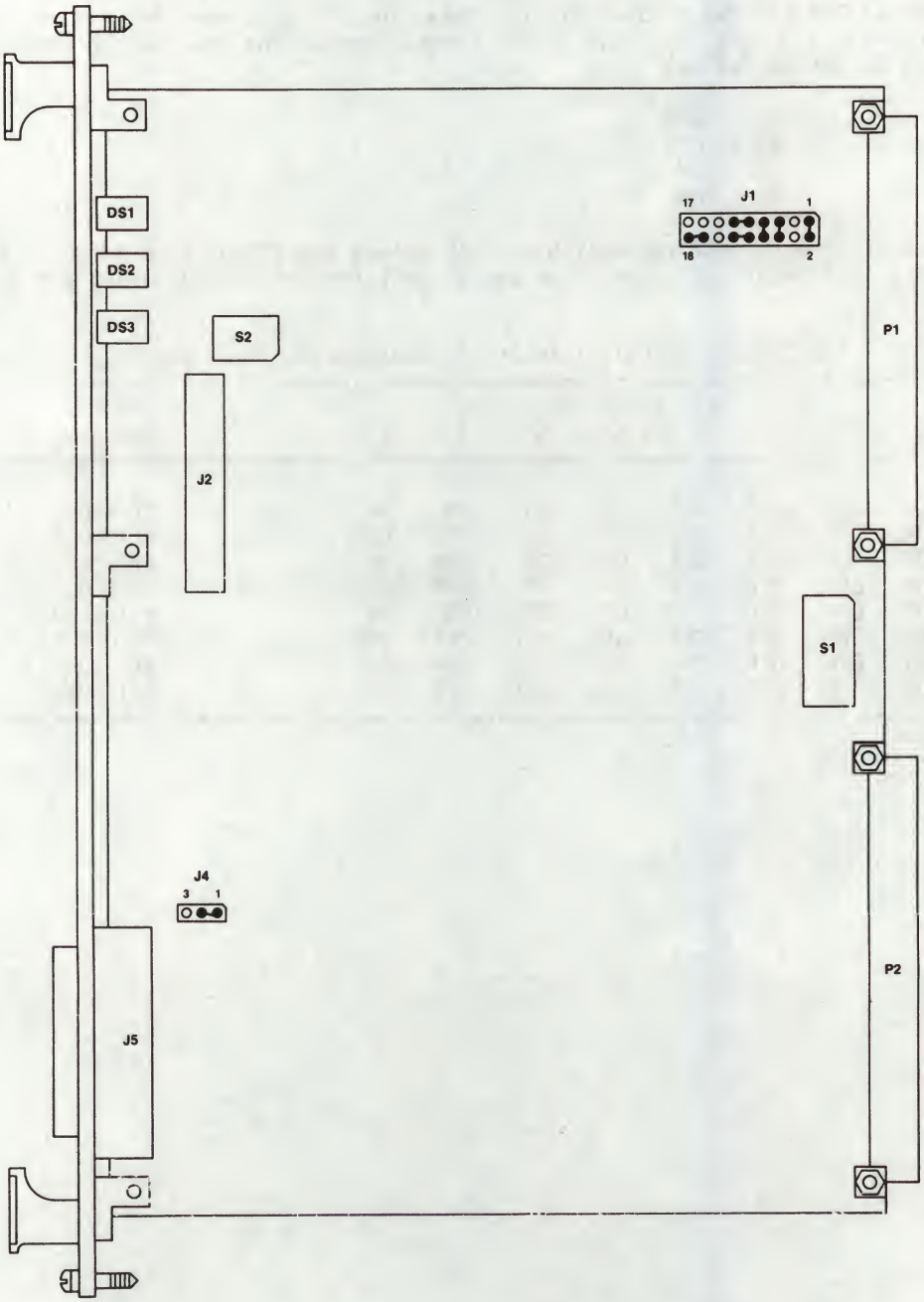


FIGURE 4-5. MVME332XT Jumper Header and Switch Locations

4.2.6 MVME333 Intelligent Communication Controller

4.2.6.1 General Description

The MVME333 Intelligent Communications Controller module supports six full-duplex serial communication channels with four channels of DMA control. The module contains a 10 MHz MC68010 microprocessor, a 10 MHz MC68450 Direct Memory Access Controller (DMAC), 512Kb of memory, and 128Kb ROM in firmware. This microcomputer controls three Z8530 Serial Communication Controller (SCC) devices and has access to the VMEbus through an A32:D16 master interface, supported by bus requester and interrupter logic. The host system can send interrupts and command bytes to the ICC and obtain status information from the ICC through VMEbus control and status registers.

Data can be transferred between local and system memory, local memory and SCC devices, or system memory and SCC devices under DMA control. The four DMA channels can be configured to control four half-duplex or two full-duplex communication channels.

Each of the six serial channels can be configured to conform to the RS-232C standard at baud rates up to 9600. This is implemented on the MVME705A 6-Channel Serial Transceiver Module, which is connected via ribbon cable with the lower rear connector of the MVME333 module.

Space and power requirements are listed in Appendix A.

4.2.6.2 Jumper Header Locations

Header locations on the MVME333 are shown in Figure 4-6.

4.2.6.3 SYSTEM V/68 Configuration

Jumper settings for the MVME333 in a Model 2334 are listed in Table 4-10. The VMEbus request priority level is set to level 3 and SYSFAIL* output to the VMEbus is not enabled (K2). Jumpers at location K3 are set for Control and Status Register address FFFF3800. Jumpers at location K5 configure the ROM sockets for 256K EPROMs (type 27256).

The VMEbus time-out period must be set to a value greater than the longest time period that may elapse between the assertion of a bus request and the reception of a bus grant in the actual system configuration. For the Model 2334, jumpers at location K6 are set to select bus time-out at infinity.

Jumpers at area K7 are set to enable installation of ROM devices with access times of 350 nanoseconds to be installed.

Jumper area K9 determines the address mapping of local memory. For the Model 2334, RAM is placed on base address $000000 and ROM is placed on base address $100000.

For a summary of board addresses, interrupt levels, bus request levels, and bus grant levels, refer to Table 4-18.

TABLE 4-10. MVME333 Jumper Settings

HEADER	DESCRIPTION	SETTING
K1	VMEbus Request Priority Level	2-4,6-8,10-12, 13-14,15-16,23-24
K2	SYSFAIL* Output to VMEbus Disable/Enable	No Jumper
K3	VME Control and Status Register Address	1-2,3-4,11-12, 13-14,15-16
K4	Status Bit	No Jumper
K5	ROM Configuration	1-2,7-8
K6	VMEbus Time-Out Selection	7-8
K7	ROM Access Time	5-6
K8	Test Facility	Factory Use Only
K9	Local Memory Addresses	2-3

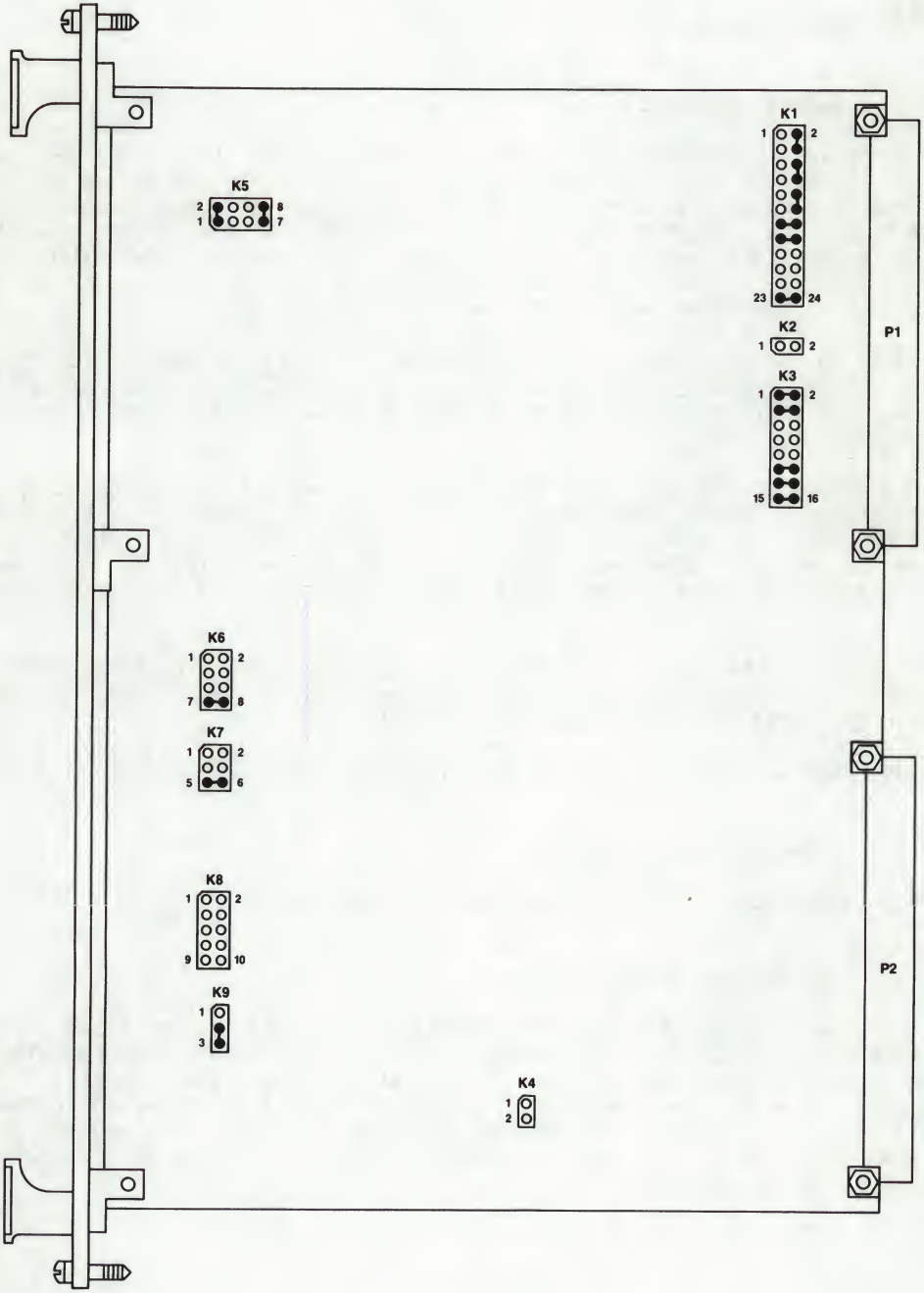


FIGURE 4-6. MVME333 Jumper Header Locations

4.2.7 MVME330 Ethernet Controller

4.2.7.1 General Description

The MVME330 is a high-performance communications processor that provides the physical interface and intelligence to attach information processing devices to Ethernet, a Local Area Network (LAN), allowing a high-speed exchange of information. The MVME330 includes a 10 MHz MC68000 microprocessor which performs supervisory functions over a Local Area Network Controller for Ethernet (LANCE). The MVME330 has 512Kb dual-access RAM with parity and no wait states, 32Kb EPROM, and a Serial Interface Adaptor (SIA).

Communication between the bus and the MVME330 is handled by the Bus Interface Protocol (BIP) software. Communication between the MVME330 and the network's physical medium (the coaxial cable) is handled by the MVME330 kernel software and the LANCE devices.

The MVME330 is connected to the VMEbus backplane and Ethernet interfacing is accomplished by cable interconnections between the MVME330 transceiver connector and the associated Ethernet transceiver equipment. The MVME330 requires an internal cable from the front edge of the controller to the rear of the system cabinet. This cable mounting occupies one transition board position.

Two versions of the MVME330 can be used in the Model 2334. The MVME330-A has XNS firmware; the MVME330-B has TCP/IP firmware. Both of these versions are based on the MVME330-1 (MC68010 microprocessor).

Space and power requirements are listed in Appendix A.

4.2.7.2 Jumper Header Locations

Header locations on the MVME330 are shown in Figure 4-7.

4.2.7.3 SYSTEM V/68 Configurations

Jumper settings for the MVME330-A and MVME330-B are listed in Table 4-11. The alternate transceiver connection is not selected (JP01), and PROM DTACK timing is set for zero wait states. Jumpers at location JP03 select 27128 PROMs and the Resource Time-out (RTO) selection is 16 microseconds (JP04). Jumpers at location JP05 select the module address. The VME address for OFFICELAN (MVME330-A) is set at DC0000. The module address for TCP/IP (MVME330-B) is set at DE0000.

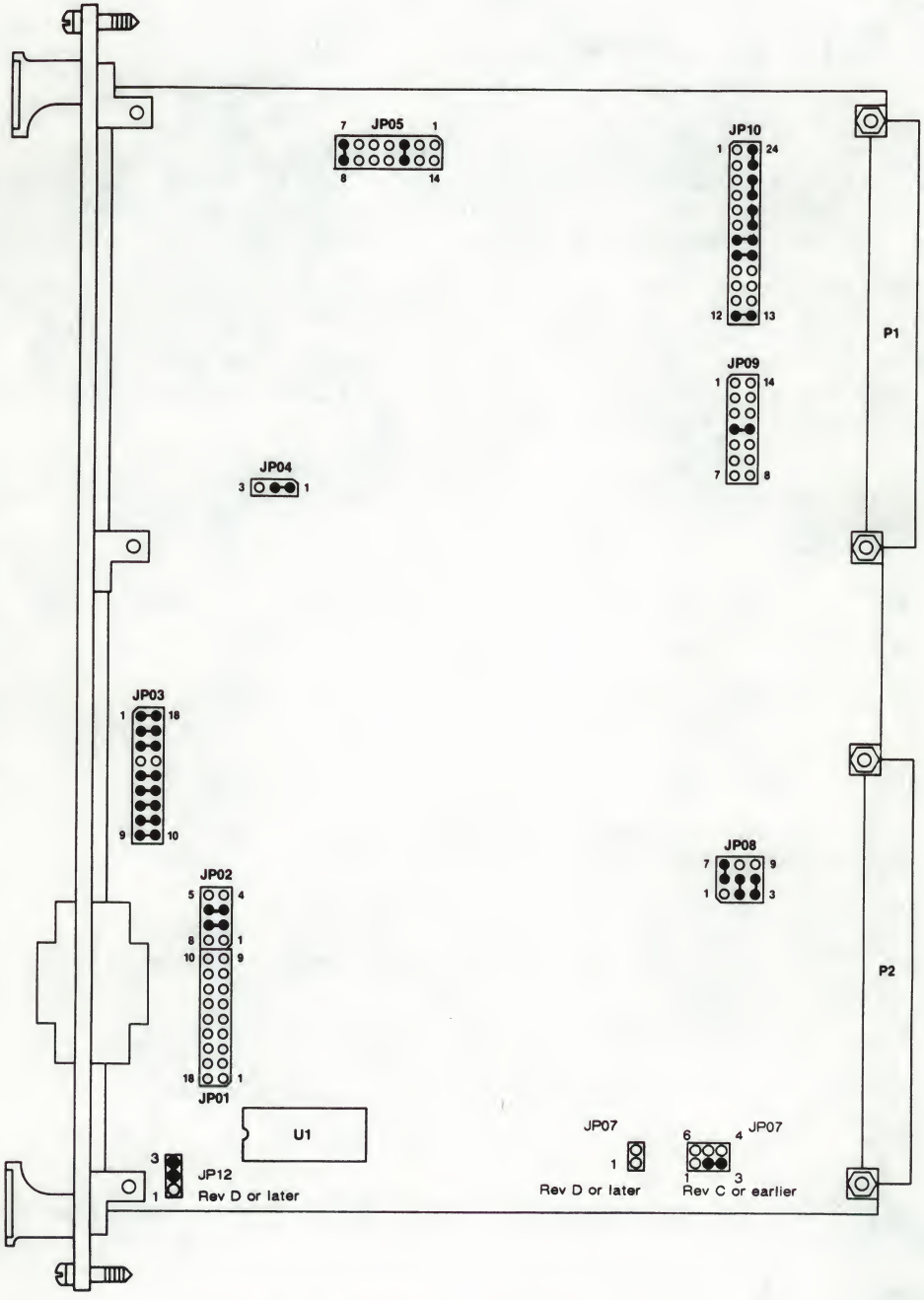


FIGURE 4-7. MVME330 Jumper Header Locations

Jumpers at location JP08 select Interrupt Acknowledge (IACK) level 4. This level corresponds to the level 4 Interrupt Request configured at location JP09. The bus request priority level selected by jumpers at JP10 is level three bus request/bus grant. The system clock is disabled.

The MVME330 board is tested with transceivers manufactured by TCL Incorporated. The Rev. C version of the MVME330 offers the capability of interfacing with either an 802.3 compatible transceiver or the Ethernet version 1 transceiver. The TCL part number for the 802.3 transceiver is 2010I. The part number for the Ethernet version 1 transceiver is 2010EB.

The MVME330 module (Rev. C) is jumpered differently for the two transceiver types. For 802.3, jumpers at location JP07 are set 2-3 (this is the default setting). The transformer in U1 should be left in for 802.3 operation. For Ethernet transceivers, jumpers at location JP07 should be set 2-3 and 1-4. The transformer at U1 should be removed, and a jumper block installed at U1 with jumpers set as shown in Figure 4-8.

TABLE 4-11. MVME330 Jumper Settings

HEADER	DESCRIPTION	SETTING
JP01	Alternate Transceiver Connection	No Jumpers
JP02	PROM DTACK Timing Select	3-6,2-7
JP03	PROM Control	1-18,2-17,3-16,5-14, 6-13,7-12,8-11,9-10
JP04	Resource Time-out Select	1-2
JP05	Module Address Select MVME330-A	3-12,7-8
JP05	Module Address Select MVME330-B	3-12
JP07	SIA Options (802.3 compat. transceiver)	2-3
JP07	SIA Options (Ethernet transceiver)	2-3,1-6
JP07	SIA Options (802.3 compat. transceiver) (On Artwork Rev. D or later)	No Jumper
JP08	Interrupt Acknowledge Level Select	2-5,3-6,4-7
JP09	Interrupt Request Level Select	4-11
JP10	Bus Request Priority Level Select	7-18,8-17,12-13, 19-20,21-22,23-24
JP11	System Clock Disable	Hardwired (not user accessible)
JP12	Ethernet Shield Grounding (On Artwork Rev. D or later)	2-3

For a summary of board addresses, interrupt levels, bus request levels, and bus grant levels, refer to Table 4-18.

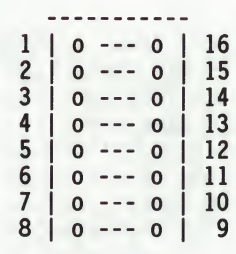


FIGURE 4-8. Ethernet U1 Jumper Block

4.2.8 MVME335 Serial and Parallel I/O Module

4.2.8.1 General Description

The MVME335 provides interface for four asynchronous serial communication devices and a parallel printer to the Model 2334. A 24-bit timer and two 16-bit timers support generation of periodic or single interrupts after elapsed periods of time. The VMEbus interface complies with all requirements for the signal driver/receiver characteristics and bus protocols, as specified in the VMEbus Specification Rev. C. The module responds to address modifier codes for short non-privileged and supervisory access and the module base address is jumper-configurable in increments of 256 bytes.

A Centronics type printer can be connected via the MVME715P transition board.

Baud rates (50 to 38400), data characteristics, and control signal functions are programmable independently for each of the four serial channels. Wake-up mode capabilities allow the MVME335 to communicate with up to 1024 serial devices. The serial I/O signal lines are at RS-232C voltage levels and are available on the four connectors.

Space and power requirements are listed in Appendix A.

4.2.8.2 Jumper Header Locations

Header locations on the MVME335 are shown in Figure 4-9.

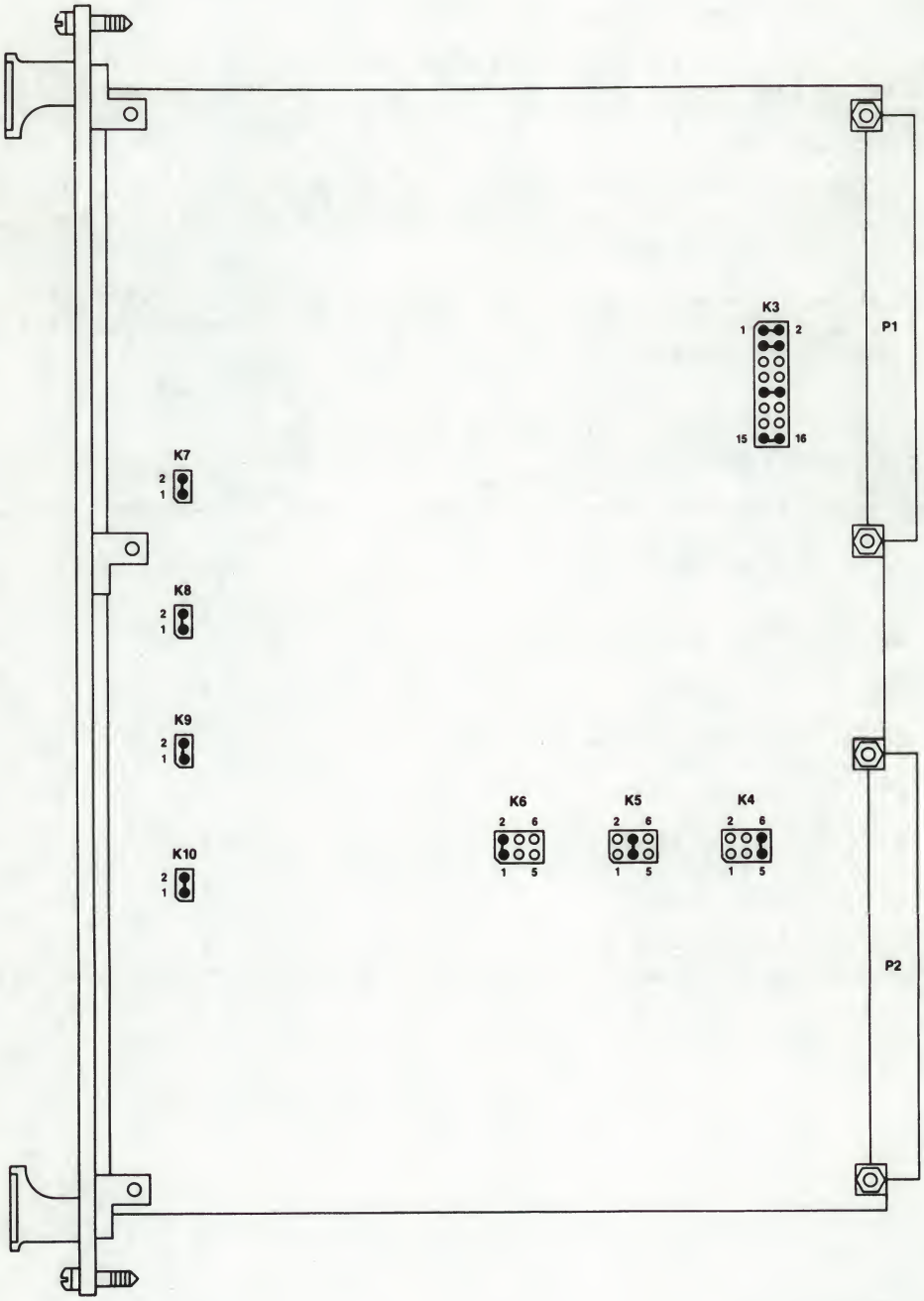


FIGURE 4-9. MVME335 Jumper Header Locations

4.2.8.3 **SYSTEM V /68 Configuration**

Jumper settings for the MVME335 are shown in Table 4-12. Jumpers at area K3 determine the base address of the module in the VME address map, selectable in increments of 256 bytes in the Short I/O address range. The module responds only to odd addresses.

Each of the address lines A08 through A15 is represented by a pin at location K3. If a jumper is set, the address bit position is 0; if a jumper is removed, the address bit position is 1.

Jumpers at locations K4, K5, and K6 are used to set the interrupt priority levels of the DUART interrupter (K4), the PI/T port interrupter (K5), and the PI/T timer interrupter (K6).

TABLE 4-12. MVME335 Jumper Settings

HEADER	DESCRIPTION	SETTING
K3	Base Address	1-2, 3-4, 9-10, 15-16
K4	DUART Interrupt Level (1-7)	5-6
K5	PI/T Port Interrupt Level (1-7)	3-4
K6	PI/T Timer Interrupt Level (1-7)	1-2
K7	Factory Setting	1-2
K8	Factory Setting	1-2
K9	Factory Setting	1-2
K10	Factory Setting	1-2

4.2.9 MVME705A 6-Channel Serial Transceiver Module

4.2.9.1 General Description

The MVME705A 6-Channel Serial Transceiver Module provides the receiver and transmitter circuits for converting the I/O signals of the MVME333 Intelligent Communication Controller to the RS-232C and/or the RS-422B standard for serial data communications. The MVME705A is made up of six identical circuits mounted on a single multilayer, double-high reduced depth VMEmodule. The serial port connectors on the front panel are connected to the printed circuit board via 26-pole flat ribbon cables which are terminated with 26-pole connectors at the PCB end. All serial connector signals for each channel on the PCB are fed in parallel to two 26-pole connector sockets. Insertion of the plug from the serial connector into one of these sockets configures the channel as DCE for connecting terminals or printers, while insertion into the other socket configures the channel as DTE for connecting modems or host computers.

For the default RS-232C configuration, MC1488 ICs are employed as line drivers to convert the TTL output signals from the MVME333 and MC1489A ICs are employed as line receivers to convert input signals for feeding to the MVME333.

Space and power requirements are listed in Appendix A.

4.2.9.2 Channel Locations

The positions of the six channels on the MVME705A are shown in Figure 4-10.

4.2.9.3 SYSTEM V/68 Configurations

Each of the six channels on the MVME705A can be configured as a terminal/printer or as a host/modem. The six-pin headers for the six channels are labeled K1, K2, K3, K4, K5, and K6. The as-shipped configuration as RS-232C DCE for connection to terminals is shown for one channel in Figure 4-11. To configure a channel DTE for connection to a modem, change the placement of the 26-pole ribbon cable to the "top" connector and set the jumpers as shown in Table 4-13.

The jumper settings for modem and terminal configuration of each channel are listed in Table 4-13.

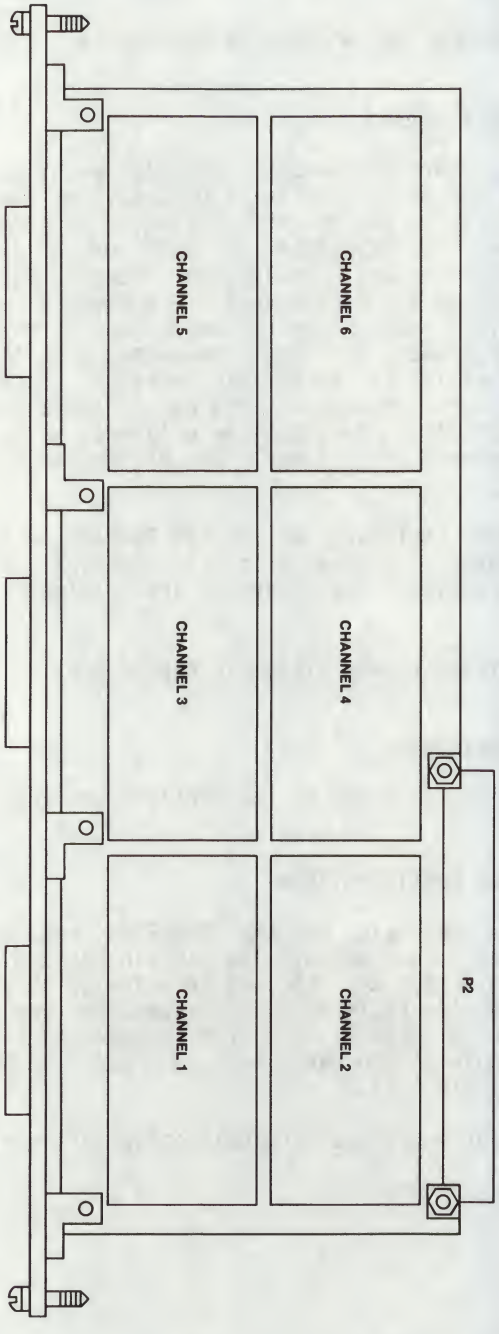


FIGURE 4-10. MVME705A Channels

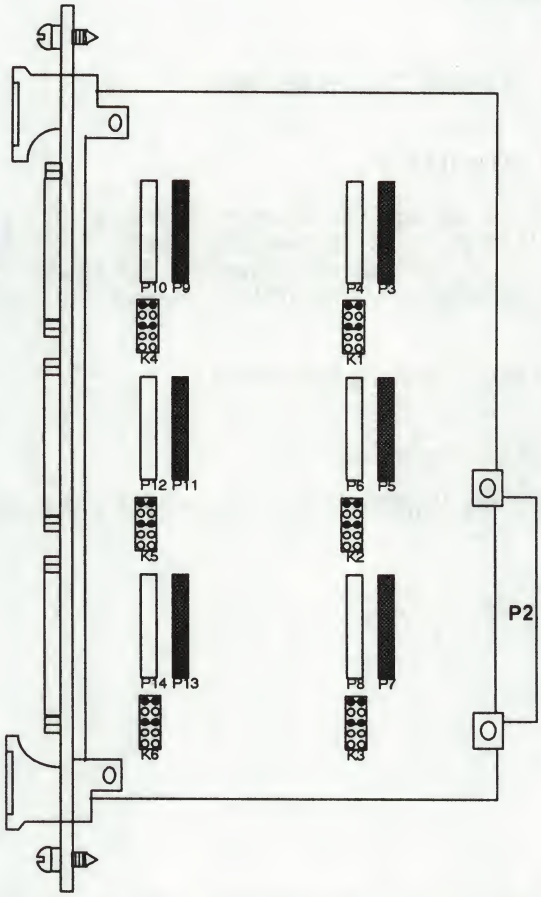


FIGURE 4-11. MVME705A Configuration For Connection to Terminal

TABLE 4-13. MVME705A Jumper Settings

HEADER	DESCRIPTION	SETTING
	TERMINAL	
K1, K2, K3, K4, K5, K6	DCE for connect to terminal.	3-4, 7-8, 9-10
	MODEM	
K1, K2, K3, K4, K5, K6	DTE for connect to modem.	1-2, 5-6

4.2.10 MVME710 Serial Port Transition Board

4.2.10.1 General Description

The MVME710 provides an adapter between the serial I/O cable connectors and the MVME332XT Intelligent Serial I/O module. Each of the eight serial ports on the MVME710 can be configured either DCE for connection to a terminal or DTE for connection to a modem. The MVME710 connects via a ribbon cable to P2 of the MVME332XT.

Space requirements are listed in Appendix A.

4.2.10.2 Jumper Header Locations

Header locations for the MVME710 transition module are shown in Figures 4-12 and 4-13.

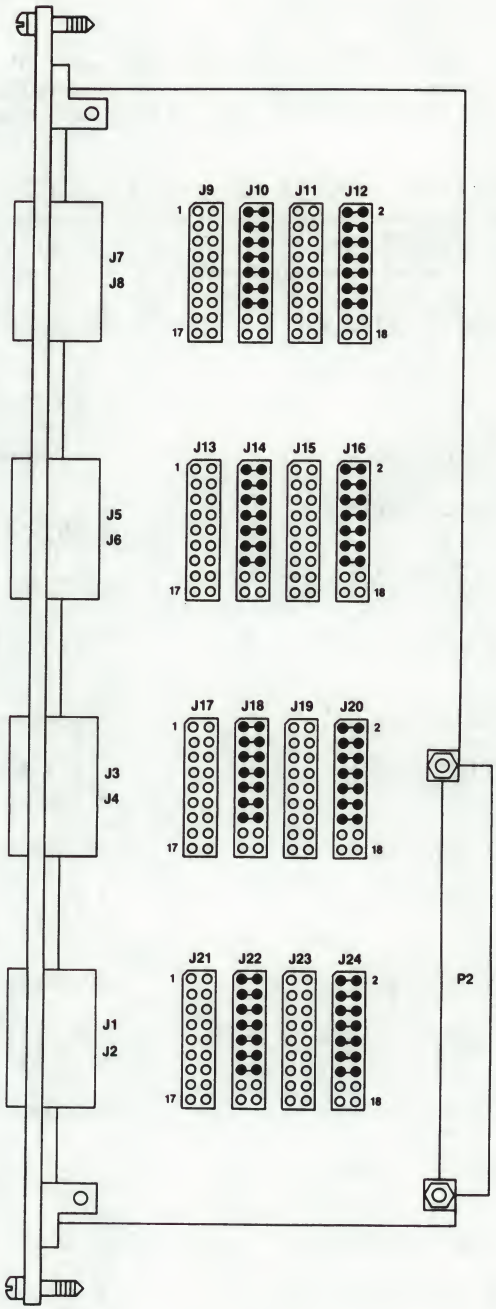


FIGURE 4-12. MVME710 Jumper Header Locations (DTE)

4.2.10.3 **SYSTEM V/68 Configurations**

In the Model 2334, all eight ports (J1 through J8) of the MVME710 are configured DTE for modem connection to use the Motorola RS-232C cross-over cable (refer to paragraphs 2.1.3, 2.3.1, and 3.3). The jumper settings are listed in Table 4-14.

TABLE 4-14. MVME710 Jumper Settings (DTE)

HEADER	DESCRIPTION	SETTING
J9	DCE/DTE Select	No Jumpers
J10	DCE/DTE Select	1-2,3-4,5-6,7-8, 9-10,11-12,13-14
J11	DCE/DTE Select	No Jumpers
J12	DCE/DTE Select	1-2,3-4,5-6,7-8, 9-10,11-12,13-14
J13	DCE/DTE Select	No Jumpers
J14	DCE/DTE Select	1-2,3-4,5-6,7-8, 9-10,11-12,13-14
J15	DCE/DTE Select	No Jumpers
J16	DCE/DTE Select	1-2,3-4,5-6,7-8, 9-10,11-12,13-14
J17	DCE/DTE Select	No Jumpers
J18	DCE/DTE Select	1-2,3-4,5-6,7-8, 9-10,11-12,13-14
J19	DCE/DTE Select	No Jumpers
J20	DCE/DTE Select	1-2,3-4,5-6,7-8, 9-10,11-12,13-14
J21	DCE/DTE Select	No Jumpers
J22	DCE/DTE Select	1-2,3-4,5-6,7-8, 9-10,11-12,13-14
J23	DCE/DTE Select	No Jumpers
J24	DCE/DTE Select	1-2,3-4,5-6,7-8, 9-10,11-12,13-14

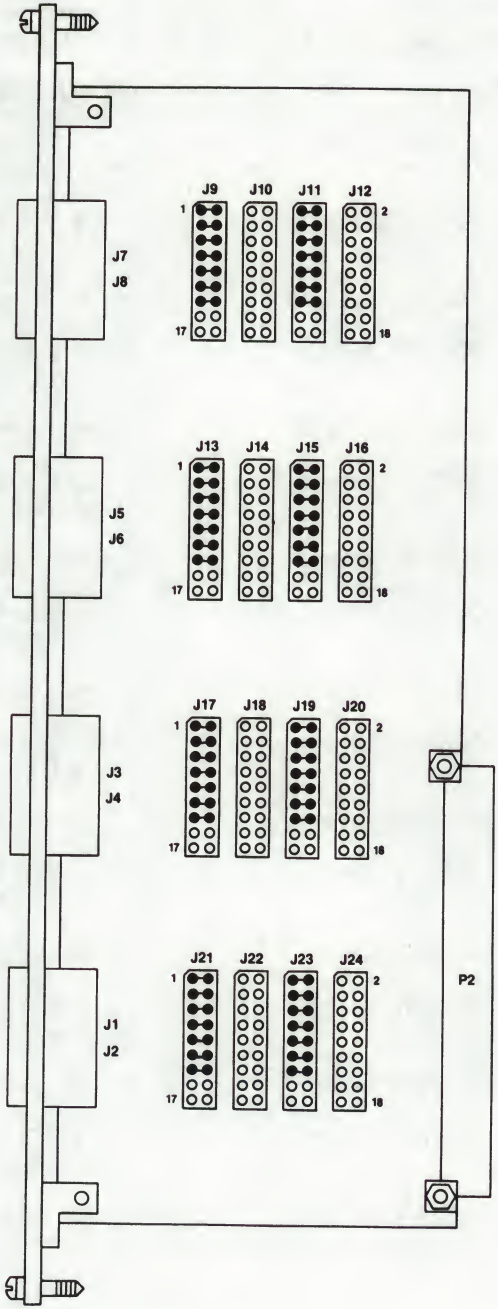


FIGURE 4-13. MVME710 Jumper Header Locations (DCE)

To configure the MVME710 transition board DCE for connect to terminals using a straight-through cable, set the jumpers as shown in Table 4-15.

TABLE 4-15. MVME710 Jumper Settings (DCE)

HEADER	DESCRIPTION	SETTING
J9	DCE/DTE Select	1-2,3-4,5-6,7-8, 9-10,11-12,13-14
J10	DCE/DTE Select	No Jumpers
J11	DCE/DTE Select	1-2,3-4,5-6,7-8, 9-10,11-12,13-14
J12	DCE/DTE Select	No Jumpers
J13	DCE/DTE Select	1-2,3-4,5-6,7-8, 9-10,11-12,13-14
J14	DCE/DTE Select	No Jumpers
J15	DCE/DTE Select	1-2,3-4,5-6,7-8, 9-10,11-12,13-14
J16	DCE/DTE Select	No Jumpers
J17	DCE/DTE Select	1-2,3-4,5-6,7-8, 9-10,11-12,13-14
J18	DCE/DTE Select	No Jumpers
J19	DCE/DTE Select	1-2,3-4,5-6,7-8, 9-10,11-12,13-14
J20	DCE/DTE Select	No Jumpers
J21	DCE/DTE Select	1-2,3-4,5-6,7-8, 9-10,11-12,13-14
J22	DCE/DTE Select	No Jumpers
J23	DCE/DTE Select	1-2,3-4,5-6,7-8, 9-10,11-12,13-14
J24	DCE/DTE Select	No Jumpers

4.2.11 MVME715P Asynchronous Serial Port/Parallel Printer Transition Board

4.2.11.1 General Description

The MVME715P provides an adapter between the serial I/O cable connector, parallel printer, and the MVME335 serial and parallel I/O module.

Space requirements are listed in Appendix A.

4.2.11.2 Jumper Header Locations

Header locations on the MVME715P are shown in Figure 4-14.

4.2.11.3 SYSTEM V/68 Configuration

In the Model 2334, all four serial ports are configured DTE for modem connection. Jumper settings are shown in Table 4-16.

TABLE 4-16. MVME715P Jumper Settings

HEADER	DESCRIPTION	SETTING
J5	DCE/DTE Select	No Jumpers
J6	DCE/DTE Select	No Jumpers
J7	DCE/DTE Select	No Jumpers
J8	DCE/DTE Select	No Jumpers
J9	DCE/DTE Select	1-2,3-4,5-6,7-8, 9-10,11-12,13-14
J10	DCE/DTE Select	1-2,3-4,5-6,7-8 9-10,11-12,13-14
J11	DCE/DTE Select	1-2,3-4,5-6,7-8, 9-10,11-12,13-14
J12	DCE/DTE Select	1-2,3-4,5-6,7-8 9-10,11-12,13-14
J13		No Jumper

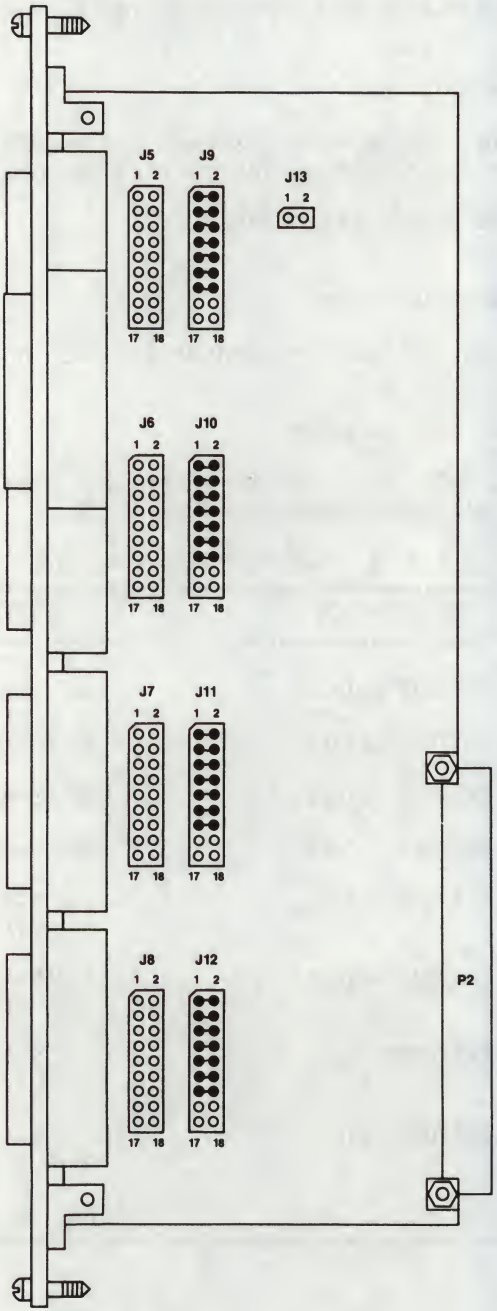


FIGURE 4-14. MVME715P Jumper Header Locations

4.2.12 MVME710F Universal Data Systems Modem

4.2.12.1 General Description

The MVME710F modem is a two-wire, full-duplex voiceband data set intended for switched-network operation. This modem is 212A compatible. It provides operation at 300 or 1200 bps and can dial on pulse or tone networks. It can answer and speed detect a calling modem.

Space and power requirements are listed in Appendix A.

4.2.12.2 Jumper Header Locations

Header locations on the MVME710F are shown in Figure 4-15.

4.2.12.3 SYSTEM V/68 Configuration

Three header locations on the MVME710F are configured for the Model 2334. Forced DTR/Normal DTR is set 1-2 for Normal DTR. Asynchronous/Synchronous is set 2-3 for asynchronous operation. 9-bit data/10-bit data/11-bit data is set for 10-bit data.

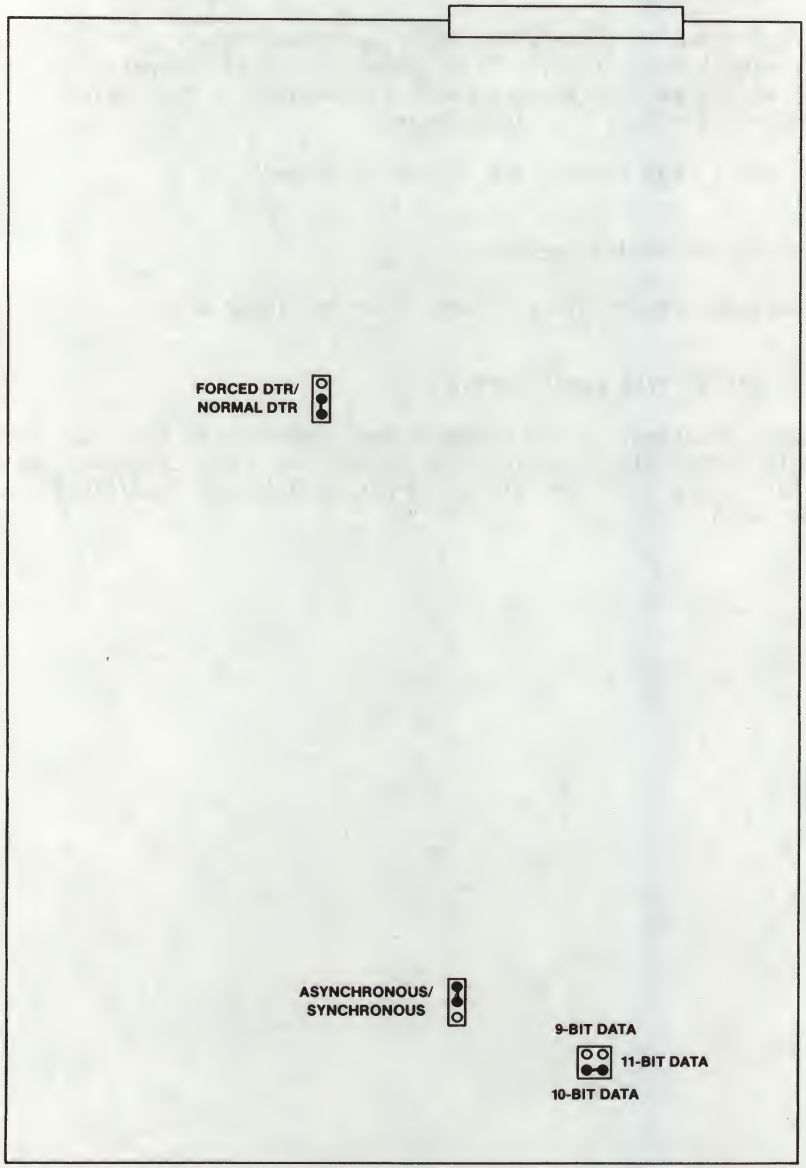


FIGURE 4-15. MVME710F Jumper Header Locations

4.2.13 MVME716 Serial Port Distribution Module

4.2.13.1 General Description

The MVME716 transition module provides two RS-232C communication ports and a remote RESET switch for the MVME134F-3. The module is connected to the microprocessor via a 26-pin ribbon cable that is plugged into the J1 connector socket on the MVME716 and the connector on the front panel of the MVME134F-3. A second cable is connected to P1 of the MVME716 via a ribbon cable to P2 of the MVME134F-3.

The console port of the MVME716 can be configured either DCE or DTE via the jumpers available on the MVME716. The SP02 port can be configured either DCE or DTE via the jumpers located on the MVME134F-3 processor board (port B configuration header). The SP02 may additionally be connected to the internal modem.

4.2.13.2 Jumper Header Locations

Header locations on the MVME716 are shown in Figure 4-16. Jumpers at locations J8 and J9 are for the console (port 1) and can be configured DCE or DTE for connection to a device via connector J7.

Port 2 can be configured either DCE or DTE for connection to a device via connector J8 by jumpers located on the MVME134F-3 microprocessor board. Refer to the MVME134 User's Manual for more detailed information on the jumpers.

Space and power requirements are listed in Appendix A.

4.2.13.3 SYSTEM V/68 Configuration

In the model 2334, Port 1 (console) on the MVME716 is configured to be the system console. Jumpers are set at location J8 and J9 as shown in Table 4-17.

TABLE 4-17. MVME716 Jumper Settings

HEADER	DESCRIPTION	SETTING
J8	DCE Select	No Jumpers
J9	DTE Select	1-2,3-4,5-6,7-8 9-10,11-12
J4	Cable Configuration	No Jumpers

Jumpers for Port 2 (SP02) may be configured for connection to an additional terminal or for connection to the internal modem, MVME710F. Refer to the MVME134 User's Manual for details on setting J21 and J25 on the MVME134F-3.

NOTE

The jumpers at locations J21 and J25 on the MVME134F-3 are set for connection to a terminal.

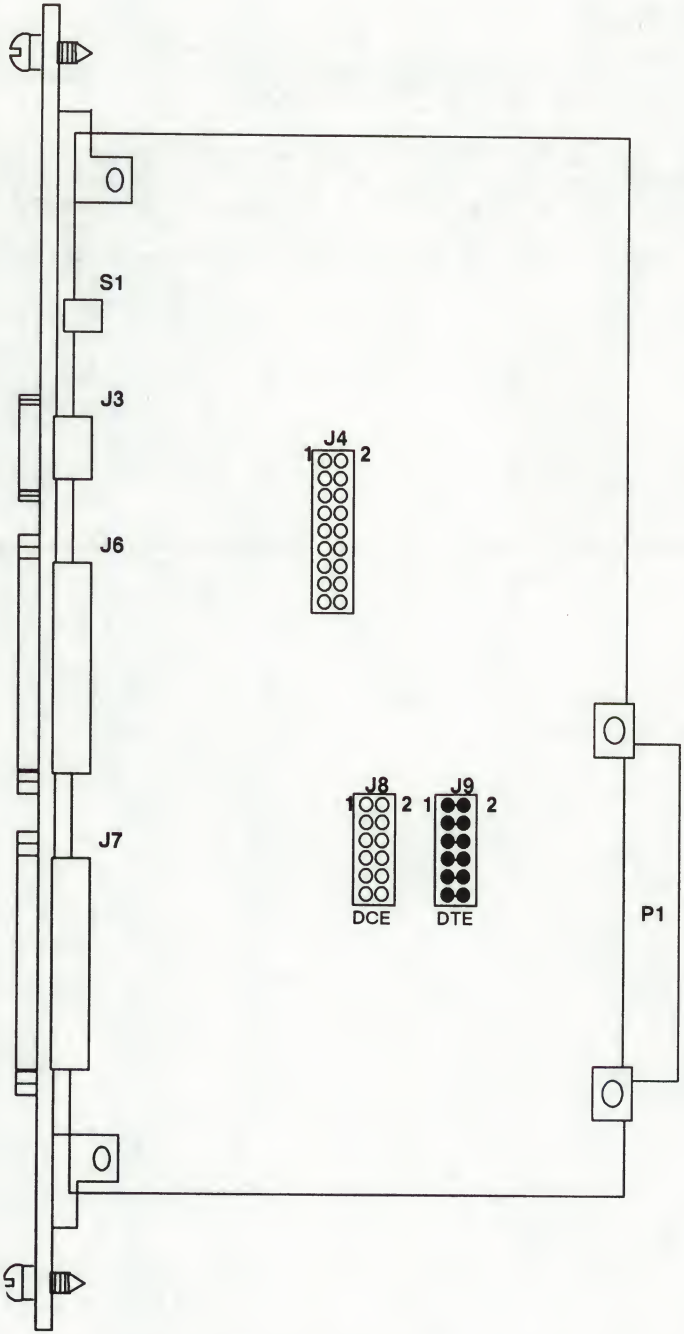


FIGURE 4-16. MVME716 Jumper Header Locations

4.3 ADDRESS ASSIGNMENTS

A summary of board addresses, interrupt levels, bus request levels, and bus grant levels for the Model 2334 is provided in Table 4-18.

TABLE 4-18. VMEmodule Reference Information

BOARD	VME SHORT/EXTENDED ADDRESS	INTERRUPT LEVEL	BUS REQUEST LEVEL	BUS GRANT LEVEL
MVME134F-3	--------		3	3
MVME350F	FFFF5000	5	3	3
MVME320BF	FFFFB000	3	3	3
MVME323F	FFFFA000	2	3	3
MVME333F	FFFF3800	2	3	3
MVME332FXT	FF780000	-	3	3
MVME330F-A	FFDC0000	4	3	3
MVME330F-B	FFDE0000	4	3	3
MVME335F	FFFF3600	3		

4.4 MODULE POSITIONS

4.4.1 Backplane

The 6-slot VME backplane has 32-bit address and data capability. The following procedures must be followed to maintain proper bus request/bus grant and interrupt acknowledge signals.

- If there is a board in a slot (ANY BOARD), remove all bus grant and interrupt acknowledge jumpers from that slot on the backplane.
- If there is an empty slot, install the four bus grant jumpers and one IACK jumper for that slot.

NOTE

Bus grant/IACK jumpers for any board are the ones nearest the "pin side" of the board.

Interrupt acknowledge is daisy-chained. The daisy-chain line passes through each board on the VMEbus. When an interrupt is acknowledged, IACKEN is driven low at slot one. Each module which is driving an interrupt request line low must wait for the low level to arrive at its board slot before accepting the acknowledge. The module accepting the acknowledge does not pass the low level down the daisy chain, thereby guaranteeing that only one module will be acknowledged.

4.4.2 Module Placement

The position of boards in the Model 2334 card cage is shown in Table 4-19. The slots, numbered 1 through 6, are read from left to right when facing the component side of the backplane. The numerical references given for each slot for a given board (e.g., "1st", "2nd", "3rd") designate the preferred positions for that board. For example, if an MVME320-B is in slot #6, the first preferred slot for the MVME350 is slot #5.

The listing of modules from 1 to 11 in Table 4-19 is also significant in determining which board is to be placed in which slot. The modules listed higher have preference over those that follow.

TABLE 4-19. VMEmodule Positions in 6-Slot Backplane

SLOT	1	2	3	4	5	6
1 | MVME134F-3	1st	/	/	/	/	/
2 | MVME320B	/	/	/	/	/	2nd | 1st
3 | MVME323	/	/	/	/	/	/ | 1st
4 | MVME350	/	/	/	/	3rd | 2nd | 1st	
5 | MVME335	/	/	/	3rd | 2nd | 1st	/	
6 | MVME332XT	/	/	/	3rd | 2nd | 1st	/	
7 | MVME333	/	/	/	3rd | 2nd | 1st	/	
8 | MVME330-A OR MVME330-B	/	/	/	3rd | 2nd | 1st	/	
9 | Filler Panel	/	/				

NOTES: 1. Although modules can work in other positions, the only supported ones are the unique configurations that result from using Table 4-19.

2. Install filler panels in empty slots for proper cooling.

Slots in the rear panel are numbered 6 through 1 on the enclosure, from left to right. Preferred positions for modules in the rear panel are shown in Table 4-20.

TABLE 4-20. Module Positions in Rear Panel

SLOT	6	5	4	3	2	1
1 | MVME716/134F-3	/	/	/	/	/	1st
2 | MVME715P/335	/	2nd		1st		/
3 | MVME710/332XT	/	2nd		1st		/
4 | MVME705A/333	/	2nd		1st		/
5 | MVME330T/330A	1st	2nd	3rd	4th	/	/
6 | MVME330T/330B	1st	2nd	3rd	4th	5th	/
7 | MVME332PA1	1st	2nd	3rd	4th	5th	/
8 | Filler Panel						

4.5 DISK DRIVE CONFIGURATION

4.5.1 Device Names

Device names are assigned to the disk drives for the Model 2334 according to the conventions described in **intro(7)** of the SYSTEM V/68 Release 3 System Administrator's Reference Manual and Appendix A of the SYSTEM V/68 Release 3 System Administrator's Guide. The naming convention described in **intro(7)** creates separate subdirectories under **/dev** for each type of disk or tape device. For disk devices the format is:

/dev/{r}dsk/[r][*cntrlr_***][***controller_number***d]***drive_number***s***section_number***

The first **r** indicates a raw interface to the disk. The second **r** indicates that the disk is on a remote system.

The format for tape device names is:

/dev/[r]mt/[*cntrlr_***][***controller_number***d]***drive_numer options density* {n}

where **r** indicates a raw device and **mt/** indicates a magnetic tape device. Tape *options* consist of one or more letters that change the operating mode of the device; refer to the manual page for the device in section 7 of the SYSTEM V/68 Release 3 System Administrator's Reference Manual. The character **n** indicates no rewind on close.

In Release 3 of SYSTEM V/68, the disk and tape controller names (*cntrlr_*) are present and must be used on command lines that specify a device. The disk devices available are:

m320_	Winchester Disk Controller, MVME320B
m323_	ESDI Disk Controller, MVME323
c	Generic Controller

The tape device available is:

m350_	Streaming Cartridge Tape Controller, MVME350

The *controller_number* is optional in the device name. If it is specified, a **d** is inserted to introduce the *drive_number*. For example, the following device names specify the same device.

/dev/dsk/m320_0s7
/dev/dsk/m320_0d0s7

Both names specify the MVME320B controller. In the first name, the *controller_number* is not specified and the *drive_number* is **0**. In the second name the *controller_number* is specified as **0**, indicating it is the first MVME320B in the system. The *drive_number* is still **0** but it is preceded by the letter **d** to separate it from the *controller_number*. In common practice, the

first name in the above example is used even in systems with more than one MVME320B controller. The *controller_number* is used only to specify the second controller, as in the name

/dev/dsk/m320_1d0s7

As described in Appendix A of the SYSTEM V/68 Release 3 System Administrator's Guide, SYSTEM V/68 provides some shorthand naming notations for day-to-day references to the devices. The notations are listed in Table 4-21.

TABLE 4-21. SYSTEM V/68 Device Naming Notation

DEVICE NAME	DESCRIPTION
/dev/[r]*xy*[*sz*]	for disk devices
/dev/[r]*xy***t[n]**	for cartridge tape devices (truncate)
/dev/[r]*xy***a[n]**	for cartridge tape devices (append)
/dev/tty*bp*	for tty devices

where *x* is the controller Logical Unit Number (LUN) (currently 0 through 9), *y* is the drive LUN on that controller, and *z* is the slice number for disk devices. For a tty, *b* is the back panel distribution board number (1, since there is only one MVME332XT module in the system) and *p* is the port on the distribution board (1 through 4 for the MVME335 or 1 through 8 for the MVME332XT).

The numbering scheme for controllers divides the set of controller LUNs into groups of two, reserving two LUNs for each controller type. Drive LUNs are assigned per the conventions of each controller. LUN assignments are shown in Table 4-22.

TABLE 4-22. Controller and Drive LUN Assignments

LUN CNTRLR	LUN DRIVE	CONTROLLER	DEVICE DRIVE
0	0	MVME320B	Winchester Disk Drive
0	2	MVME320B	Floppy Disk Drive
4	0	MVME350	Streaming Tape Drive
8	0	MVME323	ESDI Drive

For disk devices, the name **/dev/[r]***xy* without a slice number is linked to **/dev/[r]***xy***s7** which, by convention, refers to the entire disk.

In SYSTEM V/68, all the device names derived from Table 4-22 are linked to the corresponding device-specific entries in **/dev/[r]dsk** and **/dev/[r]mt**. These entries are listed in Table 4-23.

TABLE 4-23. Device Names

/dev ENTRY	DESCRIPTION
[r]dsk/m320_*ysz*	Winchester Drive *y* on MVME320B
[r]dsk/m323_*ysz*	ESDI Drive *y* on MVME323
[r]mt/m350_0t[n]	Cartridge Tape on MVME350 (truncate)
[r]mtm350_0a[n]	Cartridge Tape on MVME350 (append)

4.5.2 Drive Positions

The Model 2334 has five half-high positions for 5-1/4 inch peripherals. The top two positions are used for a cartridge tape drive. The hard disk drive is placed in the bottom two positions. The hard disk drive may be either a 67Mb ST-506 Winchester or a 160Mb ESDI drive. A floppy disk drive may be placed in the middle position. A summary of drive configuration information, including position, type, LUN, device name, and physical description, is provided in Table 4-24. Two entries are given under the "Device Name" for each device. The top entry is the SYSTEM V/68 notation, as listed in Table 4-21. The bottom entry is the full device-specific name, as listed in Table 4-23. In both names, the asterisk (*) refers to any of the slice numbers, 0 through 8 (shown as *z* in Table 4-23).

TABLE 4-24. Disk and Tape Drive Configuration

DRIVE POSITION	DRIVE TYPE	LUN CNTRLR	LUN DEVICE	DEVICE NAME	PHYSICAL DESCRIPTION
Top	Cartridge Tape	4	0	/dev/[r]mt0* /dev/[r]mt/m350_0*	60Mb Tape
Middle	Floppy	0	2	/dev/[r]02* /dev/[r]dsk/m320_2s*	1.2Mb Floppy
Bottom	Hard Disk	0	0	/dev/[r]00* /dev/[r]dsk/m320_0s*	67Mb ST-506 5-1/4" Hard Disk
		OR			
	Hard Disk	8	0	/dev/[r]80* /dev/[r]dsk/m323_0s*	160Mb ESDI 5-1/4" Hard Disk

4.5.3 Drive Compatibility and Cautions

A. All ST-506 and SA-400 drives are not the same. Although designed to meet the ST-506 and SA-400 standard, all such drives are not identical, and the MVME320B may be sensitive to some of these differences. The user will need to independently qualify the drives other than those supplied by Motorola to be used in an MVME320B system. When using 1.2Mb 5-1/4 inch drives in the high-density mode, the user must qualify the media. High-density media is not usable in the low density mode.

B. The user should take care to comply with vendor environmental specifications for drives and media, and must be careful to lock out those sectors corresponding to media defects as identified by the drive vendor and the user's incoming inspection procedures.

C. Do not open or close the floppy disk drive door when the drive is selected or about to be selected.

D. Remove the "READY" jumper, J15, when using drives that are not truly ready when this signal is asserted.

CHAPTER 5 - SYSTEM DIAGNOSTICS

5.1 INTRODUCTION

There are three levels of system diagnostics: ROM-based hardware diagnostics, disk-based Standalone System Interactive Diagnostics (SSID), and operating system-based Terminal and Printer Diagnostics (TPD). This chapter provides information about ROM-based hardware testing in the Model 2334. For information on SSID and TPD testing, refer to the appropriate system diagnostics user's guide (refer to "Documentation Roadmap" in Chapter 1).

The following topics are discussed in this chapter:

- System Start-Up User Interface
- Minimal System Self Test (SST)
- Extended SST
- System Debugger
- System Bootloader

5.2 OVERVIEW

All intelligent microprocessor-based logic boards in the computer execute Board Self Tests (BSTs) during system start-up. In addition, the Central Processing Unit (CPU) executes a System Self Test (SST) of the critical "Operating System (OS) data path." This data path includes the CPU, Memory Management Unit (MMU), memory, and selected disk controllers and drives.

The CPU SSTs do not test interaction with Intelligent Peripheral Controllers (IPCs) or Intelligent Communication Controllers (ICCs). If the BST on an IPC or ICC detects a fault during system start-up, the operating system will not be able to access that device and will then send a failure message to the system console. The SSIDs can then be loaded and executed to test and diagnose interaction with all system components.

5.3 SYSTEM POWER-UP

The primary purpose of system test and diagnostics at start-up time is to prevent a hardware fault from damaging the data on the disks and to ensure that a bootable device can be loaded and executed.

SST is executed on system power-up and hardware reset without user intervention. When a problem is detected, the user is notified on the system console.

The primary user interface during system reset or power-up is from the system console connected to the console port of the MVME716 transition board. This port is driven by the SST.

Immediately after the power is turned on, the CPU performs Minimal SST. If all tests pass, a "passed test" message is displayed on the system console screen. If a test fails, an error message is displayed if the console can be accessed. In addition, a "pass," "fail," or "not present" status is displayed for the Floating Point Co-processor (FPC) and the Paged Memory Management Unit (PMMU).

After the "passed test" message is displayed, there is a five-second delay during which the start-up sequence can be halted by typing an **h**. The Service Menu will be displayed. Refer to paragraph 3.4 for a description of this menu.

If a halt is not desired, start-up will continue into Extended SST to without user intervention.

5.4 SYSTEM SELF TEST (SST)

System Self Test is divided into two sequences, "Minimal" and Extended." The Minimal SST performs tests on the local processor resources. The Extended SST consists of additional CPU board tests and system tests of other boards on the VMEbus.

5.4.1 Minimal SST

After system power-up or reset, Minimal SST is executed. Minimal SST is a sequence of tests designed to test critical local processor resources required for basic CPU operation and console I/O. The following tests are performed:

- MPU register and instruction tests
- ROM checksum test
- Local RAM (8k) patterns test
- CPU addressing mode tests
- Processor exception processing tests
- Local Command/Status Register (CSR) test
- Serial loopback testing (chip internal) of onboard ports (port 1 system console and port 2 internal modem)
- Non-destructive system memory sizing on 128Kb boundaries
- First good 16k of system memory tests
- Floating Point Coprocessor tests
- PMMU Coprocessor tests
- Board initialization

If any of these tests fail, the processor halts and the fail LED on the board edge is illuminated. This LED can be seen only if the cover of the Model 2334 is removed.

If all tests pass, the SST message is displayed:

```
Testing Complete
```

After this message is displayed, there is a five-second delay to allow the user to halt the start-up sequence (refer to paragraph 5.3). Halting the start-up sequence prevents destructive memory tests from being executed and allows the use of the debugger to examine system memory.

After the five-second delay, Extended SST is executed.

5.4.2 Extended SST

The Extended SST sequence performs tests on the CPU, cache, MMB, and PMMU. In addition, Extended SST performs tests on all memory boards in the system and the selected disk boot controller and device (default or alternate).

The following tests are performed during Extended SST:

- MPU Tests
- MC68020 (onchip) Cache Tests
- Status Register Tests
- CPU Board Counter Timer (CIO) Tests
- ROM Tests
- Serial I/O Port Tests
- Bus Error Tests
- VMEbus Tests
- Floating Point Coprocessor Tests
- PMMU Tests
- Real Time Clock Tests
- Boot Controller and Device Test

During Extended SST, a test display line message is displayed on the console for each test. This test line message displays the test that is currently running and then displays "PASSED" or "FAILED." This display changes very rapidly for most of the test sequence.

If all tests pass, the following message is displayed on the system console:

```
Testing Complete
```

If an Extended SST fails ("FAILED" is displayed), testing stops, and the Service Menu displays. The test line message indicates which test failed. In some catastrophic failure modes, the test may hang or abort and display register information followed by the **134-Bug>** or **134-Diag>** prompt. All tests in the Extended SST take less than 8 seconds each to run.

The test line message contains an indication of which board to replace if the test fails. For example, if the VMEbus Short I/O test is in progress, the following message is displayed:

```
P MEM/CPU Bd:  VMEbus Short I/O ... Running -->
```

The **P** is the sub-test code for the VMEbus tests. The **MEM/CPU Bd:** message indicates that in the event of a failure the memory boards should be replaced first; if failure persists, the CPU board should be replaced.

If all tests pass, Extended SST goes directly to the bootloader and attempts a boot from the default device (controller 8, LUN 0), or the previously selected alternate boot device.

5.5 SYSTEM DEBUGGER

The Bug facility provides the following debug and evaluation tools:

- Memory examine and modify in byte, word, or long accesses. This can be a single location, page (256 bytes), or a specified range.
- Memory search for byte, word, long, or ASCII string in a specified range.
- Memory fill for byte, word, or long in a specified range.
- Memory compare and verify.
- Download and upload capability in S-record format from either port on the CPU.
- Single-line assembler and disassembler.
- Go to specified address and execute.
- Trace single or multiple instructions.
- Address breakpoints.
- Data conversion.

In addition to the debug capabilities, the debugger provides extensive board and system test capability. All tests executed at start-up can be executed manually.

5.6 SYSTEM BOOTLOADER

The ROM-based bootloader loads the first 512 bytes from the default controller and disk. Based on the data contained in the UIB (2nd half of 512 bytes), the firmware configures the controller with drive parameters. Based on data contained in the VID (1st half of 512 bytes), the firmware loads the disk-based bootloader from the specified location on the disk and executes it.

The ROM-based bootloader always defaults to booting from the default controller, first drive, file **/stand/sysV68**. The default controller, drive, or file can be modified using the "Select Alternate Boot Device" menu item (refer to section 3.4 for additional information about this menu). Prior to booting from the alternate boot device, the controller, drive, and file are displayed.

5.7 STANDALONE SYSTEM INTERACTIVE DIAGNOSTICS (SSID)

The Standalone System Interactive Diagnostics (SSID) program allows field engineers and customers to test and diagnose system problems. It also provides a high level of confidence that the system hardware is installed and functioning properly.

The SSID program runs in a standalone environment; it does not interact with the operating system at any time. It can reside on a bootable floppy, a cartridge tape, or as an independently bootable file within the operating system **root** file system. SSID is selected at boot time in place of the operating system. Once booted, it has complete control over all hardware and peripherals.

SSID operates through a menu system. Its extensive help facilities guide the user through the test and diagnosis of the system. The SSID user interface is friendly and oriented toward both skilled and unskilled personnel. Optional remote communication capability allows off-site fault diagnosis with an optional internal modem.

SSID is furnished as a bootable diskette or tape, or as a bootable file in the SYSTEM V/68 boot tape. For further references for SSID, consult the Documentation Roadmap (refer to paragraph 1.3) and the SSID Software Release Guide (SRG).

CHAPTER 6 - SYSTEM SOFTWARE OVERVIEW

6.1 FUNCTIONAL DESCRIPTION

SYSTEM V/68 oversees the execution of many user programs which seem to execute simultaneously because of the system's ability to time-share the processor among all the programs. Actually, each program is scheduled to use the processor for a short period of time, to the exclusion of all other programs. This time-sharing makes it possible for many users to be using the system simultaneously. It also makes accounting necessary to manage the system properly.

The concept of a "process" was developed to allow the operating system to keep track of each program and its use of system resources. The process includes the program executing and information about the various internal parts of the processor affected by the program (such as memory registers, the name of the current directory, the status of open files, or information recorded at login time).

The operating system software includes the SYSTEM V/68 kernel, the Bourne shell command interpreter, the file system, and various user and system commands. The kernel is the basic resident software on which the entire system relies. It is the only permanently resident part of the system. The kernel consists of system primitives, including various facilities to maintain the file system, support system calls, and manage system resources.

The shell command interpreter, which is itself a user process executing under control of the kernel, allows the user to communicate with the operating system. A user invokes processes by issuing commands to the shell. Furthermore, a user can invoke another shell process using the shell command (sh(1)).

6.2 KERNEL

6.2.1 Kernel and User Modes

The primary purpose of the kernel is to control system resources and user and system processes. In SYSTEM V/68, a user executes programs in an environment called a user process. When a system function is required, the user process enters the kernel by a processor trap. During this trap, there is a distinct switch of environment. Beforehand, the process is in the "user mode"; afterward, the process is said to be in a "kernel mode."

In the normal definition of processes, the user and kernel mode are different phases of the same process (they never execute simultaneously). Each process is a distinct entity, able to execute and terminate independently of all other processes. In fact, it is not always necessary for the user to be logged into the system while those processes are executing. From a strictly functional

standpoint, it can be said there are no "system" processes; instead, there are simply processes in either a user or kernel mode. Each system process (or kernel mode of a user process) has its own stack.

When stored in primary memory, a user process occupies a specific address space. The address space associated with the process has certain access permissions for the user and the kernel. As a process changes mode from user to kernel and back, the access permissions to various structures in that address space change. Due to the different access permissions, those various structures can be visualized as being within either the user or kernel mode. These two modes can then be thought of as different entities, both associated with one process. Thus, certain structures are part of the kernel mode and certain structures are part of the user mode.

6.2.2 User Mode

The user mode consists of several structures maintained by the kernel mode. These structures (the text segment, the data segment, and the stack) consist of text, data, or information needed by the kernel mode. The data segment has two sections: initialized data and uninitialized data. The uninitialized data segment is called the bss segment and all bytes in it are set to zero when the process is created. Also associated with the user mode is a stack. The stack section, which can only grow, is managed by the kernel during the execution of subroutine linkage instructions. A process in user mode may execute from a read-only text segment, which is shared by all processes executing the same program. The memory savings and swapping efficiencies are significant when large, commonly used programs are shared.

6.2.3 Process Table

A process is the execution of an image; most SYSTEM V/68 commands execute as separate processes. Processes are created (or spawned) by the system primitive, "fork."

All the process structures are tied together by a process table, with one entry for each active process. As long as a process is in the system, it has an entry in the process table. Essentially, removing a process' entry in the table is the final act that terminates that process. Therefore, not all processes listed in the process table need to be running (for example, a process could be "sleeping").

6.2.4 Interprocess Communication

The kernel provides several means by which processes can communicate with each other, including pipes, messages, shared memory, semaphores, and signals. Signals are the most frequently used means for a process to indicate the occurrence of an event that may affect another process. There are two specific system calls involved in interprocess signaling: the **kill(2)** system call used to send a signal and the **signal(2)** system call used to specify how the signal will be handled.

6.2.5 Scheduling

Process scheduling allows many processes sharing one CPU to be synchronized. It is accomplished with the sleep/wakeup mechanism. This mechanism allows coordination and optimization of the actions of a large number of processes. All active processes will be either "sleeping" (non-runnable and waiting for an event), on the run queue, or actually running (only one process at a time can run). Any process may be resident (in primary memory) or swapped (in secondary memory) at any point in time. The run status and residence status are maintained from the process table.

Which of the many possible processes is to run next? Associated with each process is a priority. Interactive terminal events have high priority, disk events are low, and alarm events (performed at a certain time of day) are very low. All user process priorities are lower than the lowest system priority. This means kernel processes will always run before any user process. The priority of kernel processes is not affected by CPU usage. Therefore, their priority remains constant unless a return to user mode is made. User process priorities are assigned by an algorithm based on the amount of recent compute time consumed by the process.

6.2.6 Swapping

One separate process in the kernel, the swapping process, swaps user processes, or parts of user processes, in and out of primary memory. Swapping out means the image is copied to secondary memory and the primary memory it occupied is freed. Swapping in means allocating primary memory for a process and reading its segments into primary memory where the process will compete for the central processor with other loaded processes. Memory layout is shown in Figure 6-1.

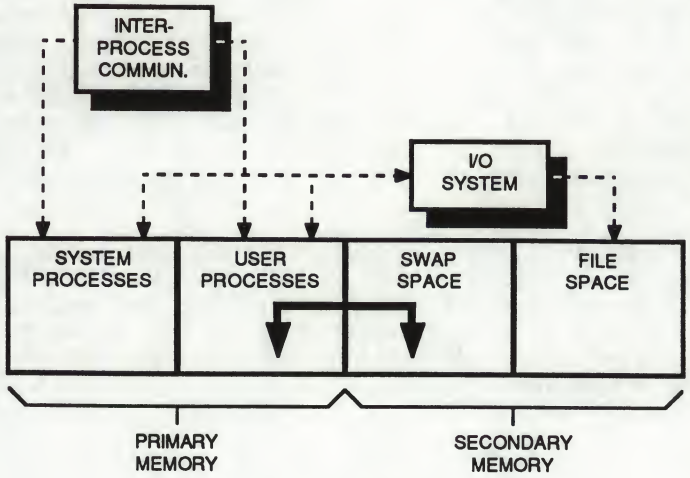


FIGURE 6-1. Memory Layout

A process terminates for one of two reasons: an explicit call to **exit(2)** or the default action of a signal. After finding a signal, a process looks for a handling routine. If none is found, the process is forced to call **exit(2)**.

6.3 FILE SYSTEM

6.3.1 Structure

The file system of SYSTEM V/68 consists of a highly uniform set of directories and files arranged in a tree-like structure (refer to Figure 6-2). Using this tree structure, files can be attached anywhere onto a hierarchy of directories. To the operating system, all files are physically the same (a one-dimensional array of bytes ending with EOF); however, the system keeps track of the file type in the file's i-node. Files are named by sequences of 14 or fewer characters (filenames).

6.3.2 Files

There are three types of file: ordinary files, directory files, and special files. In SYSTEM V/68 files normally reside on a disk. The kernel accesses all three types of files in the same way. The user and user application programs must interpret the files appropriately.

Because no particular structuring is expected by the system, an ordinary file contains whatever information the user places in it (e.g., English text, source programs, or binary object programs). Any file that is not a directory or a special file is an ordinary file.

Directory files (also referred to as directories) provide the mapping (paths) between the names of files and the files themselves, and thus induce a maplike structure on the file system as a whole. Each user has a directory of files that are treated in like manner. Although a directory behaves exactly like an ordinary file, because it can only be written by the system, the system controls the structure of directories. The system also maintains several directories for its own use. One of these is the "root" directory (which may be considered the base directory). Any one of the files in the system can be found by tracing a path through a chain of directories until the desired file is reached.

Special files constitute the most unusual feature of the file system. Each supported I/O device is associated with at least one special file. Special files are read and written just like ordinary files, but requests to read or write result in activation of the associated device handler rather than the normal file access mechanism. An entry for each special file normally resides in some subdirectory of **/dev**.

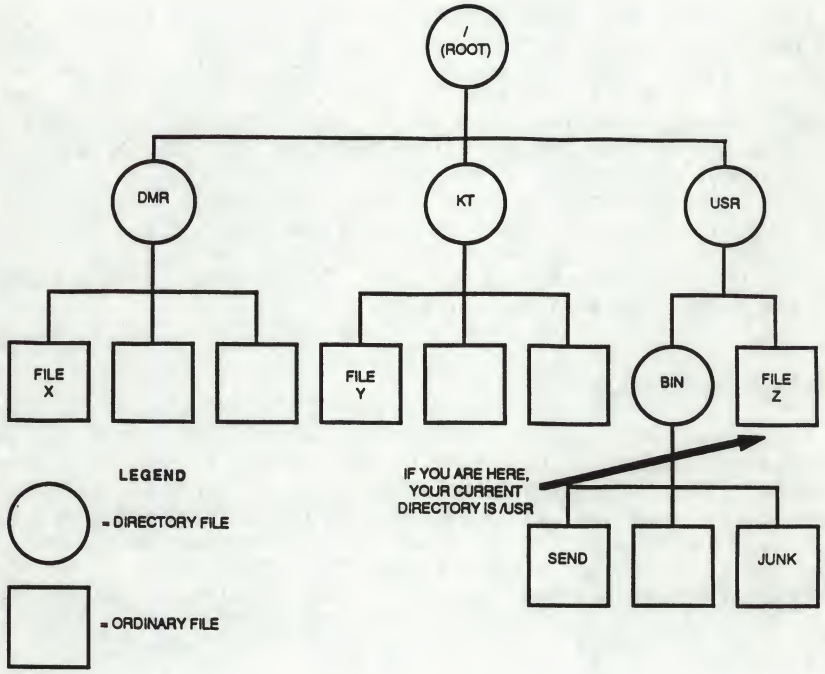


FIGURE 6-2. Hierarchical File System

6.3.3 Absolute Pathnames

When the name of a file is specified to the system, it may be specified as a pathname, which is a sequence of directory names, each separated by a slash (/), which ends with a filename. This sequence of directories preceding the filename is called a prefix. SYSTEM V/68 uses certain conventions when reading the prefix. If the prefix begins with a slash, the search begins in the root directory. This is called a full pathname. The pathname

/usr/bin/send

causes the system to search the root directory for directory "usr," then to search "usr" for "bin," and finally to find file "send" in "bin." The file "send" may be an ordinary file, a directory, or a special file. As a limiting case, the name / refers to the root directory itself.

6.3.4 Relative Pathnames

A null prefix (or any prefix that does not begin with a slash) causes the system to begin the search in the current user directory. The simplest form of pathname (e.g., "send") refers to a file that is found in the current directory. This relative pathname allows a user to quickly specify a subdirectory without needing to know (or input) the full pathname. This is just one of several mechanisms built into the file system to alleviate the need to remember pathnames. For example, files can be linked across directories. Therefore, by linking a file to the current directory, the user need not supply a prefix when accessing the file. Also, the prefix ".." refers to the parent directory (the directory containing the current directory). When a process is created, a current directory and a root directory are associated with that process.

6.3.5 Access Permissions

Although the access (read, write, and execute) protection scheme is simple, it has some unusual features. Each user of the system is assigned a unique user identification (ID) number as well as a shared group identification number. When a file is created, it is marked with the user ID and group ID of its owner. Also given for new files is a set of protection bits that specify independent read, write, and execute permission for the owner of the file, for other members of the group, and for all other remaining users (refer to **chmod(1)**). The execute permission bit for a directory file is interpreted as "search" permission in that directory.

6.3.6 Disk Data Structure

The SYSTEM V/68 file system is a disk data structure accessed completely through the block I/O subsystem. A disk is considered a randomly addressable array of blocks. The operating system actually views memory physically as 512-byte sectors and converts the sector numbers to the logical block numbers. This is invisible to the user. The first sector, set aside for booting procedures, is unused by the file system. The second sector is the "superblock."

The superblock contains a description of the file system (or volume) and includes the following:

- Size of the i-list and the entire volume
- Free block list and the number of free blocks
- Free i-node list and the number of free i-nodes
- Read-only status
- Mount device, pack name, and file system name
- File system type

Several file systems can be mounted simultaneously on different devices. Each mounted file system has a superblock and i-list. The i-list is after the superblock. It is nothing more than a list of file definitions. Each file definition is a multibyte structure called an i-node. The SYSTEM V/68 user

accesses a file with a pathname, but the system itself uses the i-node to do the accessing.

The offset (or index number) for a particular i-node within the i-list is called its i-number. The combination of device name (major and minor) and i-number serves to uniquely name a particular file. To speed up the allocating of i-nodes, an i-node array and i-node list are maintained in primary memory in addition to the information contained in the i-node itself in secondary memory. The list and array work together to provide a buffer of up to 100 free i-nodes that can be allocated and freed quickly and efficiently.

6.3.7 I-nodes

An i-node contains a description of the file to which it points. This description includes the following information:

- The user ID and group ID of the file owner
- The file protection bits
- The physical disk address for the file contents
- The file size
- Time of creation, last use, and last modification
- The number of links to the file; that is, the number of times it appears in a directory

6.3.8 Mount Table

When another file system is mounted on the file system hierarchy, that system simply becomes an extension of the current file system. To allow mounting of other file systems (and easily unmounting them), a mount table is maintained. The mount table contains pairs of designated i-nodes and block devices. At each of the i-nodes listed, a file system is mounted (mounted on the device indicated).

6.4 I/O SYSTEM

The Input/Output (I/O) system is divided into two separate subsystems: the block I/O subsystem (structured I/O) and the character I/O subsystem (unstructured I/O).

The user communicates with the peripheral devices by system calls. The system calls to input or output are designed to eliminate the differences between the various devices and styles of access. There is no distinction between

"random" and "sequential" I/O, nor is any logical record size imposed by the system. SYSTEM V/68 also attempts to eliminate differences between ordinary disk files and I/O devices such as terminals, tape drives, and line printers.

An entry appears in the file system hierarchy for each supported device, so that the structure of device names is the same as that of filenames. Not only do the same read and write system calls apply to devices and disk files; the same protection mechanisms also apply. The functional layout of the I/O system is shown in Figure 6-3.

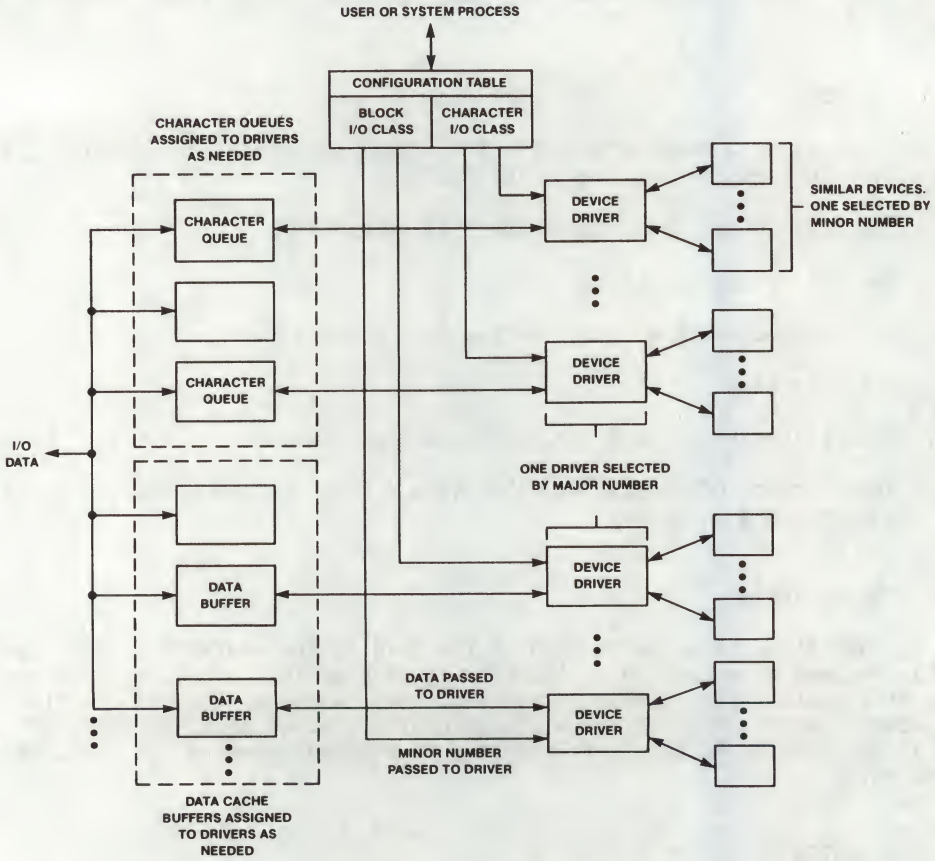


FIGURE 6-3. I/O System

Each supported I/O device is associated with at least one special file and one device driver. Devices are characterized by a major device number, a minor device number, and a class (block or character). For each class, there is an array of entry points (configuration table) into the device drivers. The major device number is used to index the array when calling software for a

particular device driver. The minor device number is passed to the device driver as an argument. The minor number has no significance other than that attributed to it by the driver. Usually, the driver uses the minor number to access one of several identical physical devices.

6.5 SHELL

6.5.1 Functions

The user communicates with SYSTEM V/68 with the aid of a command programming language called the shell. The shell is a command-line interpreter; it reads lines entered by the user and interprets the lines as a request to execute other programs. The shell also provides conditional execution and flow control features. Thus, it is also a programming language (not dissimilar to C language).

When a user logs into the system and before executing the shell, the login process sets up an execution environment. System default and user-specified profile files are read, and then the appropriate shell program is executed. The environment determines what commands the user has access to. Normally, a user will log into the system with one process associated with his or her user name. This process is the user's shell and will become the parent of all other processes the user creates. Although SYSTEM V/68 is set up to allow any program to be used as a shell, the actual shell program is normally used. The basic function of the shell from the operating system's point of view is simply to parent child processes, and a process need not be the shell program to do this. From the user's viewpoint, the shell should accept user input, execute commands, provide output, and access files.

6.5.2 Built-In Commands

There is a small subset of shell commands that are built in and differ from other commands primarily in that no separate process is created to execute these commands. They are part of the standard shell program and include all the execution and flow control constructs (refer to sh(1) for a description of individual built-in commands). All other commands are either functions, utility programs, or application programs.

6.5.3 File Descriptors

Programs executed by the shell begin with three open files with file descriptors 0, 1, and 2. When a program begins, file 1 is open for writing and is known as the standard output. Conversely, file 0 starts off open for reading and programs that must input messages entered by the user can read file 0, which is known as the standard input. File descriptor 2 starts off open for writing and is known as standard error. Files 0, 1, and 2 are normally attached to the user's terminal. Unless otherwise directed, input is taken from the terminal and output is sent to the terminal.

6.5.4 Pipes

An extension of the standard I/O notion is used to direct (or pass) the output from one command to the input of another without the use of temporary files maintained by the user. A sequence of commands separated by vertical bars (|) causes the shell to execute all the commands and to arrange that the standard output of each command be delivered (piped) to the standard input of the next command in the sequence.

A related shell feature, the &, allows asynchronous execution of commands and pipelines. If the pipeline is followed by &, the parent will not wait for the controlling process to exit before prompting the user for the next input. Also, the shell will output the process number of the controlling process to allow the user to track the progress of the command.

6.5.5 Shell Scripts

The shell can execute commands from a file. The commands are executed sequentially until an EOF is encountered or an exit command is executed. This feature allows the user to take advantage of the programming power of the shell.

For more information on the shell program, refer to **sh(1)** in the SYSTEM V/68 Release 3 User's Reference Manual and the "Shell Tutorial" chapter in the SYSTEM V/68 Release 3 User's Guide.

6.6 NETWORK SERVICES EXTENSION

SYSTEM V/68 Release 3 offers the optional Network Services Extension, which introduces the following features:

- Remote File Sharing
- STREAMS
- Transport Interface
- Networking Utilities

6.6.1 Remote File Sharing

Remote File Sharing (RFS) allows computers running SYSTEM V/68 Release 3 to share resources across a network. System administrators on an RFS network can choose directories for sharing and can select resources from remote hosts for use on their computer.

Every host in a RFS system must belong to a "domain," which is a means of logically grouping hosts for administrative and addressing purposes. A domain can be one host or several hosts, up to as many as will fit on the network.

Host administrators can maintain strict control of resources through a series of security checks, including connect security, mount security, and user mapping.

6.6.2 STREAMS

STREAMS provides a set of tools for development of operating system communication services, ranging from complete networking protocol suites to individual device drivers. The STREAMS mechanism defines standard interfaces for character I/O within the operating system kernel and between the kernel and the rest of the operating system.

A Stream is a full-duplex processing and data transfer path between a driver in kernel space and a process in user space. It has three parts:

- The Stream head provides the interface between the Stream and user processes. It processes user system calls.
- A module processes data that travels between the Stream head and driver. A module is interconnected between the Stream head and driver by user process, with no requirement for kernel programming, assembly, or link editing.
- A driver (or Stream end) provides the services of an external I/O device or an internal software driver (pseudo-device driver). It has one or more nodes associated with it in the file system and is accessed using the **open**(2) system call.

Using a combination of system calls, kernel routines, and kernel utilities, STREAMS passes data between a driver and the Stream head in the form of messages. The mechanism provides a framework with a user interface that is compatible with the existing character I/O interface available in earlier systems.

For additional information, refer to **streamio**(7), the STREAMS Primer, and the STREAMS Programmer's Guide.

6.6.3 TCP/IP

SYSTEM V/68 Release 3 TCP/IP is a transport interface that provides services required by RFS. The code runs on the main system processor and the Ethernet Node Processor. The two processors communicate in shared memory on the Ethernet Node Processor, with the Ethernet Node Processor signaling the main processor via interrupts.

The transport service supports the connection mode and the connectionless mode of transfer. Connection mode is circuit oriented and supports data transfer over an established connection in a reliable, sequenced manner. The connectionless mode is message oriented and supports data transfer in self-contained units with no logical relationship required among the units.

Applications programs access the Transport Provider by using the Transport Interface routines in the Network Services Library. The Transport Provider uses kernel-level programs to send the information to the desired physical device, e.g., the Ethernet Node Processor. By using the Transport Interface, application programs will be able to access other Transport Providers that may be available in the future.

APPENDIX A - SYSTEM SPECIFICATIONS

This appendix provides specifications for the Model 2334 system, the 6-slot enclosure, controllers (disk, tape, serial, communications, Ethernet), and mass storage devices. Space and power requirements for VMEmodules are also given.

TABLE A-1. Model 2334 Specification Summary

Microprocessor	MC68020
Bus	32-bit VMEbus
Floating Point	IEEE P754 format
Local Area Network (LAN)	Ethernet Version 1 or 802.3
Tape Interface	QIC-02 (1/4-inch cartridge tape)
Disk Interfaces	ST-506 5-1/4 inch hard disk drives (67Mb), ESDI 5-1/4 inch hard disk drives (161Mb)
Operating System	SYSTEM V/68 Release 3
Network Protocols	TCP/IP, OFFICELAN
Data Communications Protocols	SNA/SDLC, Bisync, Async
Data Communications Interface	RS-232C
Languages	C, ANSI FORTRAN 77, COBOL

TABLE A-2. Model 2334 Enclosure Specifications

DIMENSIONS	
Height	21.0" (533 mm)
Depth	17.5" (445 mm)
Width	7.1" (180 mm)
Weight (typical)	75 lb. (34.1 kg)
TEMPERATURE	Operating: +5 degrees to +40 degrees C, 10 degrees C/hour max. gradient Non-Operating: -40 degrees C to +60 degrees C (transit) -10 degrees C to +60 degrees C (storage)
RELATIVE HUMIDITY	Operating: 10% to 80% non-condensing; 15% RH/hour max. gradient Non-operating: 10 to 90%, non-condensing
ALTITUDE	Operating: 0 to 3,000 meters Non-operating: 0 to 6,000 meters Transit: 0 to 6,000 meters
ELECTRICAL SPECIFICATIONS	110 VAC nominal 47Hz - 63Hz (90 - 132 VAC tolerance) 220 VAC nominal 47Hz - 63Hz (180 - 264 VAC tolerance) 4 A max. at 110 VAC 2 A max. at 220 VAC
POWER CONSUMPTION	350 W max.; 225 W typical (varies with features)
HEAT PRODUCED	1200 BTU max.; 770 BTU typical
TRANSPORTATION, PACKAGED	Packaging and shipping containers and procedures comply with the current NSTA preship test procedures.
SHOCK	
Operating	.5 g
Non-Operating	15 g
ELECTROSTATIC DISCHARGE	
No observable effect	5,000 volts
No operator-perceived errors	12,000 volts
No permanent damage	24,000 volts
ACOUSTIC NOISE	50 dBA maximum
EMISSIONS	Meets VDE 0871/6.78, Class A Meets FCC Part 15, Sub-part J, Class A

TABLE A-3. Controller Specifications

CONTROLLER TYPE	INTERFACE	NUMBER OF CHANNELS/DRIVES AS EMPLOYED	TRANSFER RATE (PER SECOND)
Hard Disk	ST-506	1	5 Mbits
Floppy	SA-400	1	250 Kbits
ESDI	ESDI	1	10 Mbits
Cartridge Tape	QIC II	1	Up to 90 Kbits
8-Port Serial	RS-232C	8	Up to 19.2 Kbits
Communications	RS-232C	6	Up to 19.2 Kbits
Ethernet	CSMA/CD	1	10 Mbits

TABLE A-4. Mass Storage Devices

FORM-FIT	INTERFACE	UNFORMATTED CAPACITY	FORMATTED CAPACITY	AVERAGE ACCESS TIME
DISK DRIVES				
5-1/4"	SA-400	1.6Mb	1.2Mb	181 ms
5-1/4"	ST-506	85Mb	67Mb	28 ms
5-1/4"	ESDI	182Mb	161Mb	16.5 ms
TAPE DRIVES				
5-1/4"	QIC II		60Mb	

TABLE A-5. VMEmodule Space and Power Requirements

VMEmodule	SPACE REQUIRED	POWER REQUIREMENTS
MVME134FP	Single slot Double-high VME standard	+5 Vdc @ 5.0 A +12 Vdc @ 250 mA -12 Vdc @ 250 mA
MVME320B	Single slot Double-high VME standard	+5 Vdc @ 4.0 A +12 Vdc @ 60 mA typical -12 Vdc @ 20 mA typical
MVME323	Single slot Double-high VME standard	+5 Vdc @ 4.3 A
MVME350	Single slot Double-high VME standard	+5 Vdc @ 3.0 A
MVME330A/B	Single slot Double-high VME standard	+5 Vdc @ 4.7 A +12 Vdc @ 0.6 A ± 5%
MVME332XT	Single slot Double-high VME standard	+5 Vdc @ 4.5 A +12 Vdc @ 100 mA max., 50 mA typical -12 Vdc @ 100 mA max., 50 mA typical
MVME333	Single slot Double-high VME standard	+5 Vdc @ 3.8 A
MVME335	Single slot Double-high VME standard	+5 Vdc @ 1.1 A +12 Vdc @ 75 mA max., 55 mA (typ.) -12 Vdc @ 75 mA max., 55 mA (typ.)
MVME710F	7" x 4". Not a standard VMEmodule; is installed in chassis.	+5 Vdc @ 0.1 A +12 Vdc @ 50 mA max. -12 Vdc @ 50 mA max.
MVME710	Double slot Double-high	0 power
MVME705A	Double slot Double-high	+5 Vdc @ .5 A max., 0.2-1.0A typical +12 Vdc @ 150 mA max., 0-110 mA typ. -12 Vdc @ 150 mA max., 0-110 mA typ.
MVME715P	Double slot Double-high	0 power
MVME716	Single slot Double-high	0 power

APPENDIX B - TERMINALS

This appendix provides information about the terminals supplied by Motorola. Two classes of Motorola-supplied terminals can be used with the Model 2334: the TM220 and the TM3000-series. This appendix summarizes the features, characteristics, and switch settings of the terminals.

NOTE

For unpacking instructions and detailed installation procedures, consult the manual that was supplied with the terminal. This appendix gives only a general overview on TM220 and TM3000-series terminals.

TABLE B-1. Terminal Models

VENDOR	FUNCTION	KEYBOARD(S)	MODEL NUMBER
Ampex	VT220 compatible	VT220	TM2201
	Monochrome non-graphic	TM3200 (DEC-style)	TM3220 (green) TM3220A (amber)
		TM3100 (IBM-style)	TM3180 (green) TM3180A (amber)
	Color non-graphic	TM3200	TM3241
		TM3100	TM3179
Kokusai	Monochrome graphic	TM3200	TM3220G (green) TM3220AG (amber)
		TM3100	TM3180G (green) TM3180AG (amber)
	Color graphic	TM3200	TM3241G (color)
		TM3100	TM3179G

B

B.1 FEATURE AND SETUP REQUIREMENTS

Terminals other than a TM220 or TM3000-series used with the Model 2334 must meet certain setup requirements to operate successfully. These setup requirements use the Motorola TM220 feature definitions. For terminals other than the TM220, the definitions may vary or may not be selectable. Thus, some terminals may not operate correctly.

B.1.1 General Feature Requirements

- DEC 200 8 bit controls
- User-defined keys unlocked
- User features unlocked
- Numeric keypad
- Normal cursor keys
- No new line
- North American keyboard

B.1.2 Host Communication Setup Requirements

- Transmit = 9600 bps (This applies to local terminals. Remote terminals usually operate at 1200 bps.)
- Receive = Transmit
- XON/XOFF flow control
- XOFF at 128
- 8 data bits, no parity
- 1 stop bit
- No local echo (full-duplex)
- EIA port, data leads only (if applicable)
- Disconnect, 2-second delay (if applicable)
- Limited transmit (if applicable)

B

B.1.3 Preferred Display Setup Requirements

- 80 column
- Interrupt control selected
- Autowrap selected
- Jump scroll
- Light text, dark screen

B.1.4 Keyboard Setup Requirements

- Typewriter keys

B.2 TM220 TERMINAL DESCRIPTION

The TM220 terminal has two parts: the display unit and the keyboard. The display unit has a 14-inch diagonal screen and is mounted on a pedestal which allows the unit to tilt and swivel. The pedestal holds the ON/OFF switch for the terminal, two ports for attaching the unit to other equipment, and a port for connecting the keyboard to the display unit.

The brightness control is located underneath the lower right side of the display unit. A screen-saver (CRT saver) built into the terminal turns off the display after about 10 minutes if no new characters are sent to the screen. If the screen has been darkened because of the CRT Saver feature, the first character typed restores the display but is not sent to the screen.

CAUTION

WHEN DECIDING WHERE TO INSTALL THE TERMINAL, DO NOT BLOCK ANY OF THE AIR VENTS ON THE UNIT. ALL AIR VENTS MUST BE KEPT CLEAR FOR THE UNIT TO COOL PROPERLY DURING OPERATION.

B.2.1 Cable Connection

The TM220 terminal has two standard RS-232C serial port interfaces. The PRIMARY port is used to connect the terminal to the Model 2334. The PRINTER port is used to connect the terminal directly to a printer.

To connect the terminal to the computer and/or printer, connect the Motorola RS-232C cable end labeled WORKSTATION/PRINTER to the terminal. The other end labeled DPU should be connected to the Model 2334.

When connecting the terminal to the Model 2334, make sure that the pins on the terminal connector are matched properly with the pins on the connector of the computer or printer.

B

B.2.2 Keyboard Connection

The keyboard port connection is located on the left side of the display unit. The keyboard connects to the terminal by attaching the keyboard cable to this port. Insertion is "keyed";i.e., there is only one way to insert the cable into the opening.

CAUTION

DO NOT CONNECT OR DISCONNECT THE KEYBOARD TO OR FROM THE DISPLAY UNIT WHEN THE POWER IS ON. ERRATIC PERFORMANCE MAY RESULT.

DO NOT ATTEMPT TO CONNECT ANOTHER MANUFACTURER'S KEYBOARD OR A KEYBOARD FROM ANOTHER MOTOROLA TERMINAL MODEL TO THE TM220 TERMINAL.

B.2.3 Power Up

The ON/OFF (power) switch is a rocker-type switch located on the right rear of the unit.

To turn on the terminal:

1. Plug the AC power cord into the proper outlet or receptacle.
2. Make sure all interface cables are connected properly.
3. Set the ON/OFF switch to 1 (rear "swing" down).

B.3 TM3000-SERIES TERMINALS

The TM3000-series terminals combine features of DEC, IBM, and Tektronix terminals into a single multifunctional terminal. Supported DEC features include complete DEC VT220 terminal emulation plus many enhancements. Support IBM features allow comprehensive software emulation of IBM 3179 and 3180 Display Stations. Supported Tektronix features include compatible Tektronix 4105 eight color graphic commands and eight color character commands.

There are two versions of the TM3000 terminal. One version is a monochrome terminal with optional graphics capabilities. The other version is a color terminal with optional graphics capabilities. For a list of model numbers, refer to Table B-1.

The TM3000 terminals support two basic types of keyboard, the TM3200 and the TM3100. The TM3200 keyboard has a typewriter-style layout for word processing and general office application usage. The TM3100 keyboard is styled after the IBM 3179 Color Display Station keyboard.

B.3.1 Cable Connection

Connect the power cable, keyboard, cable, and RS-232C cable to the back of the terminal.

The Motorola RS-232C cable end labeled WORKSTATION/PRINTER should be connected to the back of the terminal (marked HOST). The other end labeled DPU should be connected to the computer.

B.3.2 Keyboard Connection

The keyboard port connection is located on the back of the display unit. The keyboard connects to the terminal by attaching the keyboard cable to the port labeled KBD.

CAUTION

DO NOT CONNECT OR DISCONNECT THE KEYBOARD TO OR FROM THE DISPLAY UNIT WHEN THE POWER IS ON. ERRATIC PERFORMANCE MAY RESULT.

DO NOT ATTEMPT TO CONNECT ANOTHER MANUFACTURER'S KEYBOARD OR A KEYBOARD FROM ANOTHER MOTOROLA TERMINAL MODEL TO THE TM3000 TERMINAL.

B.3.3 Power Up

The terminal has two control switches, an ON/OFF switch, and a keylock. The "on" position is indicated by a "1" next to the switch. If this side is pushed down, the terminal is powered on. If the side of the switch next to the "0" is pushed down, the terminal does not have power. Some terminals have a keylock switch that disables the keyboard.

The front of the terminal contains a single knob which brightens or darkens the screen.

To turn on the terminal:

1. Plug the power cord into the proper outlet or receptacle.
2. Make sure all interface cables are connected properly.
3. Set the ON/OFF switch to the "on" position by pushing down the side labelled "1."

B

B.4 TERMINAL SPECIFICATIONS

TABLE B-2. Specifications for TM220 and TM3000-Series Terminals

TM220	TM3000
Display Screen	
14-inch non-glare screen Amber or green phosphor	14-inch non-glare screen Red, green, sky blue phosphor (color models only)
60 or 65 Hz refresh rate	50 or 60 Hz refresh rate
Video Attributes	
Bold, reverse video, blink, underline, and combinations of these	Bold, reverse video, blink, underline, and combinations of these
Cursor Type	
9 x 12 dot matrix, block or underline, cursor ON/OFF	Block or underline; blinking, steady, or invisible
Character Sets	
266+ displayable characters Custom characters	Multinational character set Special graphics set National replacement character (NRC) set Down-line-loadable (soft) character set
Keyboard	
Slimline keyboard, tiltable, detachable with coiled cable Adjustable keyclick LED indicators	Slimline keyboard, tiltable, detachable coiled cable Piezoelectric buzzer LED indicators
Communication Features	
Baud rates: 75, 110, 150, 300, 600, 1200, 2400, 4800, 9600, 19,200 XON/XOFF RS-232C	Baud rates: 75, 110, 150, 300, 600, 1200, 2400, 4800, 9600, 19,200 XON/XOFF RS-232C
Physical Dimensions - Terminal	
Width: 13.5" (343 mm) Depth: 13.5 " (343 mm) Height: 14.5" (369 mm) Weight: 19.4 lb (8.7 kg)	Width: 13.3" (388 mm) Depth: 16.2" (411 mm) Height: 15.6" (395 mm) Weight: 39.8 lbs (18.1 kg)

TABLE B-2. Specifications for TM220 and TM3000-Series Terminals (cont'd)

TM220	TM3000
Physical Dimensions - Keyboard	
Width: 21.2" (538 mm)	Width: 20.4" (519 mm)
Depth: 7.6" (193 mm)	Depth: 7.4" (188 mm)
Height: 1.5" (38 mm)	Height: 1.2" (30 mm)
Weight: 2.0 lbs. (0.9 kg)	Weight: 3.3 lbs. (1.5 kg)
Power Requirements	
115 VAC/60 Hz	110 VAC/60 Hz
230 VAC/50 Hz	220 VAC/50 Hz

B.5 TERMINAL INFORMATION DATA BASE

Terminals are described in the **terminfo** data base so that applications programs such as **vi**(1) and **curses**(3X) can work with different types of terminals without changes to the programs. Source descriptions in **terminfo** give terminal capabilities, padding requirements, and initialization sequences.

Names for terminals in **terminfo** follow conventions described in **terminfo**(4) and **term**(5) in the SYSTEM V/68 Release 3 Programmer's Reference Manual. Names for the TM220 and TM3000-series terminals are given in Table B-3.

Information for preparing a source description is given in **terminfo**(4). The **tic**(1M) utility is used to compile the source description and place it in **/usr/lib/terminfo**. The utility **infocmp**(1M) can be used to compare or print out **terminfo** descriptions. When used with the **-I** option, **infocmp** returns information about the terminal exported by the **TERM** variable. The value of **TERM** can be determined with the command **env**(1).

Chapter 10 of the SYSTEM V/68 Release 3 Programmer's Guide gives additional information about working with the **terminfo** data base.

TABLE B-3. Terminfo Names

MODEL NUMBER	DESCRIPTION	TERMINFO NAME (80-COLUMN TERMINAL)	TERMINFO NAME (120-COLUMN TERMINAL)
TM2201	VT220 Compatible	tm220, tm2201	tm220w, tm2201w
TM3220	Monochrome Non-graphic (DEC-style keyboard)	tm228, tm3220, tm3220i	tm228w,tm3220w tm3220iw
TM3180	Monochrome Non-graphic (IBM-style keyboard)	tm228i, tm3180, tm3180i	tm228iw, tm3180w tm3180iw
TM3241	Color Non-graphic	tm229, tm3241, tm3241i	tm229w, tm3241w, tm3241iw
TM3179	Color Non-graphic	tm229i, tm3179 tm3179i	tm229iw, tm3179w, tm3179iw
TM3220G	Monochrome Graphic (DEC-style keyboard)	tm3220g	tm3220gw
TM3180G	Monochrome Graphic (IBM-style keyboard)	tm3180g	tm3180gw
TM3241G	Color Graphic	tm3241g	tm3241gw
TM3179G	Color Graphic	tm3179g	tm3179gw

APPENDIX C - PRINTERS

Printers must be set up or configured specifically for the Model 2334. This is done through the switch settings usually located on the front panel of the printer. This appendix lists the general hardware settings for many common printers, as well as the switch settings for Motorola-supplied printers.

Software instructions must be given to the system to complete the configuration so that the printer can work with the Model 2334. The software configuration instructions are found either in the Software Release Guide or in the installation manual for the software.

NOTE

For unpacking instructions and detailed installation procedures, consult the manual that was supplied with the printer.

C.1 GENERAL HARDWARE SETTINGS

The following hardware settings and configurations are required for all printers that are to be used with the Model 2334.

C.1.1 Dot Matrix and Line Printer Requirements

- 9600 bps
- Serial operation
- 8 data bits
- No parity
- XON/XOFF buffer and printer status
- 703 control code interpretation

It may be required that other codes be set to specific values, depending on the printer manufacturer. Setting items listed above, however, will normally enable the basic functioning of a printer connected to the system.

C.1.2 Impact (Letter Quality) Printer Requirements

- 1200 bps
- Serial operation
- 7 data bits
- Even parity
- XON/XOFF buffer and printer status

Other signals for variable printer functions may have to be enabled, depending on the printer manufacturer.

C.2 PRINTER DESCRIPTIONS

Motorola versions and equivalent printers are listed in Table C-1.

TABLE C-1. Motorola Equivalent Printers

MOTOROLA VERSION	EQUIVALENT PRINTER
PT3001	Diablo 630
PT3102	Centronics 150
PT3202	Centronics 152
PT3401	Centronics 353
PT3403	Centronics 352
PT3501	Fujitsu SP830
PT3601	Data Products B300/600
PT3801	Fujitsu Series 2000 (Model 2100)
PT3901	Fujitsu Series 2000 (Model 2200)

C.2.1 PT3001 Printer

The hardware switch settings that allow the PT3001 printer to work with the Model 2334 are listed in Table C-2. For illustrations and detailed information on how to set these switches, refer to the user's guide that is shipped with the printer. The PT3001 is Motorola's version of the Diablo 630 printer.

TABLE C-2. PT3001 Switch Settings

SWITCH	SETTING
Left Rotary Switch	Select Printwheel Type
Right Rotary Switch	Select Position 1
Left Dip Switch	All Positions OFF
Right Dip Switch	1 OFF, 2 OFF, 3 ON, 4 OFF, 5 ON, 6 ON, 7 OFF, 8 OFF

C.2.2 PT3102 and PT3202 Printers

The hardware switch settings that allow the PT3102 and PT3202 printer to work with the system are listed in Table C-3. The user's guide that is shipped with the printer has illustrations and detailed instructions on how to set these switches. The PT3102 is Motorola's version of the Centronics 150 dot matrix printer (serial printer). The PT3202 is Motorola's version of the Centronics 152 dot matrix printer (serial printer).

TABLE C-3. PT3102 and PT3202 Switch Settings

SWITCH	SETTING
Front Panel DIP switches	All positions OFF
Rear Panel DIP Switches (NOTE)	1 = ON; 2-8 = OFF

NOTE: The printer cover must be removed to check and set the Rear Panel DIP Switches.

C.2.3 PT3401 Dot Matrix Printer with Letter Quality Feature

The required settings on the PT3401 include feature and configuration settings. Detailed instructions for configuring the printer are found in the manual shipped with the printer. The PT3401 is Motorola's version of the Centronics 353 printer. Some application software may require different settings, which will be listed in the manuals for that application software.

Feature settings for the PT3401 printer are listed in Table C-4.

TABLE C-4. PT3401 Feature Settings

FEATURE	SETTING
Horizontal Tab	008 HOR TAB
Vertical Tab	006 VER TAB
Forms Length	006 Forms L
Characters Per Inch	10 CPI
Lines Per Inch	6 LPI
Country Character Set	USA Country
Automatic Line Feed	0 AUTO LF
Vertical Margin	1 VER MAR
Audio Alarm	1 ALARM
Memory	MEMORY

The hardware settings to allow the PT3401 printer to work with the system when printing from the operating system are listed in Table C-5.

TABLE C-5. PT3401 Configuration Settings

CODE	PARAMETER	DISPLAY	MEANING
-	Speed	960	9600 bps
1	Serial or Parallel	1	Serial Operation
2	Data Bits	3	8 Data Bits
3	Parity	0	No Parity
4	Buffer Status	3	XON/XOFF Used
5	Printer Status	3	XON/XOFF
6	Reverse Channel Polarity	0	RC Not Used
7	Reserved, Not Used		
8	Reserved, Not Used		
9	Inverted Data Strobe	0	Normal
10	Inverted Data Bit	0	Normal
11	Bit 8 Control	1	Normal
12	703/ANSI	0	703
13	Prime On Select	0	Disabled
14	Prime On Delete	0	Disabled
15	Print On Paper Motion	2	No CR
16	Page Mode	0	Disabled

C.2.4 PT3403 Printer Without Letter Quality Feature

The PT3403 (without letter quality feature) is Motorola's version of the Centronics 352 printer. The hardware switch settings that allow the PT3403 printer to work with the system are listed in Table C-6. For illustrations and detailed information on how to set these switches, see the user's guide that is shipped with the printer.

TABLE C-6. PT3403 Switch Settings

SWITCH	SETTING							
DIP Switch #1	1	2	3	4	5	6	7	8
	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF
DIP Switch #2	1	2	3	4	5	6	7	8
	ON	ON	ON	ON	ON	ON	ON	ON
DIP Switch #3	1	2	3	4	5	6	7	8
	ON	ON	ON	ON	OFF	ON	ON	ON
DIP Switch #4	1	2	3	4	5	6	7	8
	ON	ON	ON	ON	OFF	ON	ON	ON

C.2.5 PT3501 55 CPS Letter Quality Printer

The PT3501 is Motorola's version of the Fujitsu SP830 printer. Some settings may require changes to function with some software application packages; these settings are described in the user documentation for these application packages. Settings that allow the Motorola PT3501 to work with the system when printing from the operating system are listed in Table C-7.

TABLE C-7. PT3501 Switch and Control Settings

SWITCH OR CONTROL	SETTING
Form Length Rotary Switch	11"
Column Space	12
Line Space	6
Print Wheel	Switch B2 = ON (This may differ depending on the type of printwheel being used.)
Proportional Spacing (PS)	Switch PS = OFF
Paper Out Disable Switch	OFF for Tractor Feeder ON for Sheet Feeder
Automatic Line Feed Switch (AUT LF)	OFF
Work Processing Switch (WP)	OFF
Automatic Carriage Return (AUT CR)	OFF
Echo Test Switch	OFF
Baud Rate Switches (B0, B1, B3) (9600 baud)	B0, B1 = ON B3 = OFF
Duplex Switch (FD or HD)	FS
Parity Switch (EN or OD)	ED
Parity Mark Switch	OFF
ETX/ACK or DC1/DC3 Switch	DC1/DC3
DTR Switch	OFF
TM3 Logic PCB Straps	01001 (OFF-ON-OFF-OFF-ON) (This PCB is located at the rear, under the cover. If all other switches are current and operational requirements have been checked, a service representative must be called to check these straps.)
There are other TM jumper (strap) positions on the logic PCB. These positions are overridden by the front panel controls and switches and should not be disturbed. If a sheet feeder is to be used with the PT3501 printer, the following jumpers must be verified on the TM9 jumper block.	
TM9 Jumper Block	10101 (ON-OFF-ON-OFF-ON) The remaining three jumpers at location TM9 select the language font and will be set at OFF for the English language option.

C.2.6 PT3601 Printer

The PT3601 is Motorola's version of the Data Products B300/600 line printer. The hardware switch settings that allow the PT3601 printer to work with the system are listed in Table C-8. For illustrations and detailed information on how to set these switches, refer to the user's guide that is shipped with the printer.

TABLE C-8. PT3601 Switch Settings

SERIAL INTERFACE CCA PRINTED CIRCUIT BOARD SWITCHES								
SWITCH	SETTING							
DIP Switch #1	1	2	3	4	5	6	7	8
	OFF	OFF	ON	ON	ON	ON	ON	ON
DIP Switch #2	1	2	3	4	5	6	7	8
	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
DIP Switch #3	1	2	3	4	5	6	7	8
	ON	OFF	OFF	OFF	OFF	ON	ON	OFF
DPC CENTRONICS-COMPATIBLE INTERFACE PCB SWITCHES								
SWITCH	SETTING							
DIP Switch #1	1	2	3	4	5	6	7	8
	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
DIP Switch #2	1	2	3	4	5	6	7	8
	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF
DIP Switch #3	1	2	3	4	5	6	7	8
	OFF	ON	OFF	OFF	ON	OFF	OFF	OFF
DIP Switch #4	1	2	3	4	5	6	7	8
	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF

C.2.7 PT3801 and PT3901 Printers

The PT3801 is Motorola's version of the Fujitsu Series 2000, Model 2100 printer. The PT3901 is Motorola's version of the Fujitsu Series 2000, Model 2200 printer. The switch settings for the PT3801 and PT3901 are identical, as listed in Table C-9. For detailed instructions on how to set these switches, refer to the user's guide that is shipped with the printer.

TABLE C-9. PT3801 and PT3901 Switch Settings

MEMORY CIRCUIT CARD SWITCH SETTINGS								
SWITCH	SETTING							
DIP Switch #1	1	2	3	4	5	6	7	8
	OFF	OFF	OFF	OFF	OFF	ON	ON	ON
DIP Switch #2	1	2	3	4				
	ON	OFF	OFF	OFF				
SERIAL INTERFACE CARD SWITCH SETTINGS								
SWITCH	SETTING							
DIP Switch #1	1	2	3	4	5	6	7	8
	ON	ON	ON	OFF	OFF	ON	ON	OFF

C.3 PARALLEL PRINTER INTERFACE

The MVME335 printer interface provides a printer port with Centronics-compatible signals. The handshake with the printer is performed by onboard hardware; therefore, no software overhead is required for data transfer to the printer.

Table C-10 identifies all printer port signals used on the MVME332XT and MVME335 modules by mnemonics and functional descriptions. Printer port signal locations at the front panel connector and the rear connector P2 are shown in Tables C-11 and C-12 for the MVME335. The printer port signals from the MVME332FPA1 and MVME332FPA2 are the same as Table C-11 (front connector).

C

TABLE C-10. Printer Port Signal Description

SIGNAL	DESCRIPTION
STROBE*	DATA STROBE* An active low output signal indicating that data is valid.
ACK*	ACKNOWLEDGE* An active low input signal indicating that the printer has accepted data.
DATA1..DATA8	DATA BITS 1..8 Eight data lines that transfer data bytes to the printer.
BUSY	BUSY An active high input signal indicating the printer is unable to receive data.
PAPOUT	PAPER OUT An active high input signal indicating that the printer is out of paper.
SELECT	SELECT An active high input signal indicating the printer is in a ready condition.
PRIME*	INPUT PRIME* An active low output signal used to initialize the printer.
FAULT*	FAULT* An active low input signal indicating that the printer has detected a fault condition.
GND	GROUND
CHASSIS	CHASSIS GROUND

TABLE C-11. MVME335 Front Connector Printer Port Signal Locations

PIN NO.	SIGNALS	SIGNALS	PIN NO.
1	STROBE*	GND	19
2	DATA1	GND	20
3	DATA2	GND	21
4	DATA3	GND	22
5	DATA4	GND	23
6	DATA5	GND	24
7	DATA6	GND	25
8	DATA7	GND	26
9	DATA8	GND	27
10	ACK*	GND	28
11	BUSY	GND	29
12	PAPOUT	GND	30
13	SELECT	PRIME*	31
14	GND	FAULT*	32
15	----	GND	33
16	GND	----	34
17	CHASSIS	----	35
18	----	----	36

TABLE C-12. MVME335 Connector P2 Printer Port Signal Locations

PIN NO.	SIGNALS	SIGNALS	PIN NO.
15	----	----	19
16	CHASSIS	----	20
17	GND	----	21
18	----	GND	22
19	GND	FAULT*	23
20	SELECT	PRIME*	24
21	PAPOUT	GND	25
22	BUSY	GND	26
23	ACK*	GND	27
24	DATA8	GND	28
25	DATA7	GND	29
26	DATA6	GND	30
27	DATA5	GND	31
28	DATA4	GND	32
29	DATA3	GND	33
30	DATA2	GND	34
31	DATA1	GND	35
32	STROBE*	GND	36

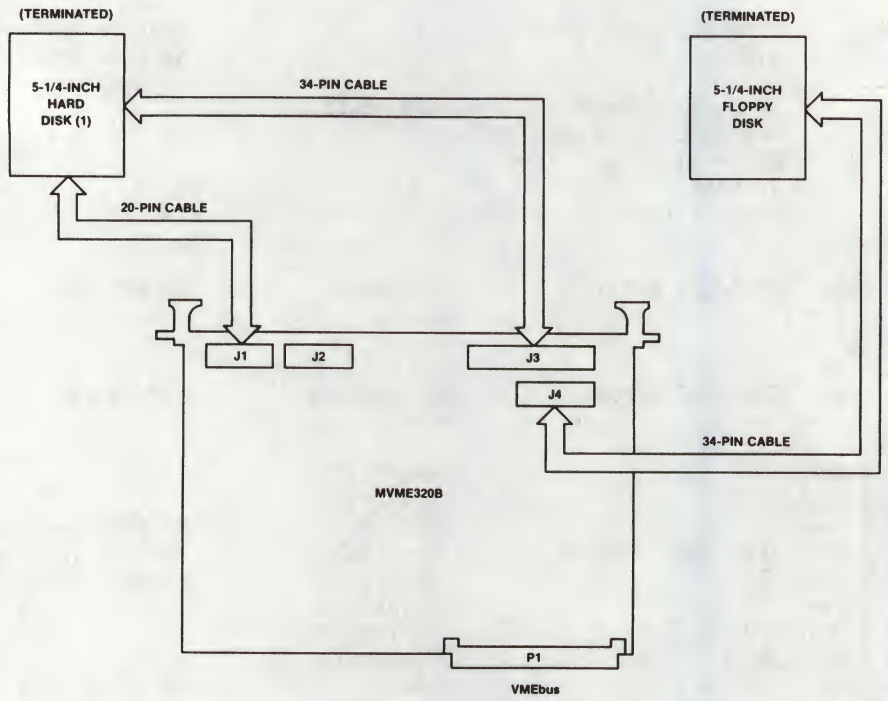
APPENDIX D - CABLING INSTRUCTIONS

TABLE D-1. Cabling Guide

FROM COMPUTER	TO PERIPHERAL	DEVICE NAME	GENERIC DEVICE NAME
MVME716			
		/dev/console	
CONSOLE	TERMINAL (Port is DTE)		Console Terminal, Service Modem, or Terminal
SP02	SERVICE MODEM or TERMINAL if no service modem is in unit (port is DTE).	/dev/tty01	
MVME330-A 15-Pin D-SUB Conn.	ETHERNET 802.3	/dev/bpp	OFFICELAN
MVME330-B 15-Pin D-SUB Conn.	ETHERNET 802.3	/dev/enpram	TCP/IP LAN
MVME710			
Board 1 Port SP1		/dev/tty11	
Board 1 Port SP2		/dev/tty12	
Board 1 Port SP3		/dev/tty13	RS-232C Devices,
Board 1 Port SP4	DTE Default	/dev/tty14	such as Terminals,
Board 1 Port SP5		/dev/tty15	Modems, Printers
Board 1 Port SP6		/dev/tty16	
Board 1 Port SP7		/dev/tty17	
Board 1 Port SP8		/dev/tty18	
MVME705A			
Board 1 Port J1	Debugger Console		Terminal
Board 1 Port J2			
Board 1 Port J3		No Specific Name	No Peripherals
Board 1 Port J4		in /dev. Mapped	can be attached
Board 1 Port J5		by BPP through	to Ports J2-J6.
Board 1 Port J6		a Socket Scheme.	
MVME715P (NOTE)			
Board 1 Port J1		/dev/tty11	RS-232C Devices,
Board 1 Port J2		/dev/tty12	such as Terminals,
Board 1 Port J3	DTE Default	/dev/tty13	Modems, Printers
Board 1 Port J4		/dev/tty14	
Board 1 Port J5		/dev/lp335_1	Centronics Printer

NOTE: Refer to **portconfig**(1M) in the SYSTEM V/68 Administrator's Reference Manual.

Floppy and hard disk cabling using the MVME320B controller module are shown in Figure D-1. Maximum cable length should not exceed 10 feet (3 M). For additional information, refer to the MVME320B VMEbus Disk Controller Module User's Manual and to the disk drive reference sheet for the drive being installed.



NOTES: (1) Only the end of each signal line (typically on the last drive) requires termination.

(2) The 5-1/4 inch hard disk uses the first 34 lines (1-34) of J3.

FIGURE D-1. MVME320B Cabling for Hard Drive and Floppy Drive

APPENDIX E - USING REMOVABLE MEDIA

E.1 LOADING AND UNLOADING A FLOPPY DISKETTE

The floppy disk slot is located in the upper left front of the computer enclosure, immediately below the cartridge tape slot.

To load a floppy diskette into the system, follow these steps:

1. Turn the floppy disk lever counterclockwise.

2. Near one corner of the floppy diskette is a square cut-out, which is the write-protect slot. Before placing the diskette in the drive, check the write-protect slot. If a label covers the square slot, you will not be able to write on the diskette.

3. Insert the diskette with the oblong cutout on the diskette going into the disk slot first, with the small round cutout on the left as you face the computer (refer to Figure E-1).

CAUTION

INSERT THE DISKETTE ONLY AFTER POWERING UP THE SYSTEM AND REMOVE THE DISKETTE BEFORE POWERING DOWN THE SYSTEM; OTHERWISE, THE DATA COULD BE DESTROYED. DO NOT TOUCH THE DISKETTE SURFACE EXPOSED BY THE CUTOUTS IN THE CARRIER ENVELOPE OF THE FLOPPY DISKETTE.

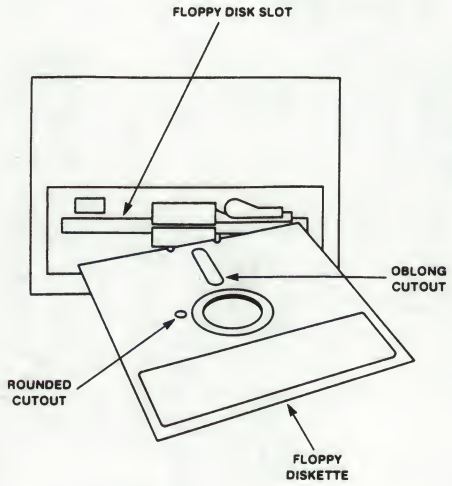


FIGURE E-1. Inserting the Floppy Diskette

4. After inserting the diskette, turn the disk level clockwise to secure the diskette. The indicator light on the floppy disk drive lights when the floppy diskette is loaded correctly (only on domestic units).

E.2 LOADING AND UNLOADING A CARTRIDGE TAPE

The cartridge tape slot is located in the upper left front of the computer.

To load a cartridge tape, follow these steps:

1. Check to make sure that the cartridge switch is aligned with the center marker before loading the cartridge.

2. Remove the tape cartridge from its plastic carrier.

3. To prohibit the writing of information onto the tape cartridge, set the write-protect switch arrow to SAFE (refer to Figure E-2.). To enable writing on the tape cartridge, set the write-protect switch with the arrow directly opposite the SAFE position.

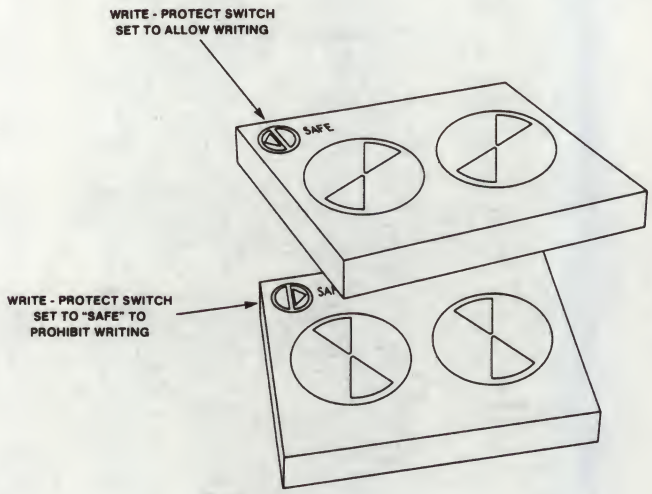


FIGURE E-2. Setting the Write-Protect Switch

4. Load the tape cartridge into the tape cartridge slot as shown in Figure E-3. Push the cartridge gently into the tape cartridge slot until the cartridge engages. Push the cartridge switch to the right to lock in the cartridge.

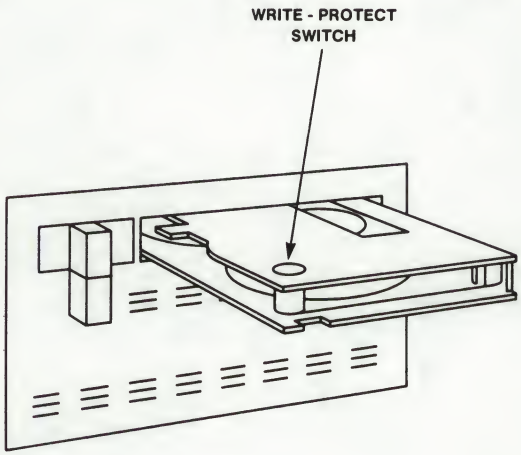


FIGURE E-3. Loading the Tape Cartridge

To unload a cartridge tape, perform the following steps:

1. Push the cartridge switch over to the left, which ejects the tape cartridge a short distance to make it easier to pull out the tape.

CAUTION

UNLOAD THE TAPE CARTRIDGE BEFORE POWERING DOWN THE SYSTEM; OTHERWISE, THE DATA ON THE CARTRIDGE COULD BE DESTROYED.

2. Pull the cartridge out of the tape cartridge slot and place the tape cartridge into its plastic carrier to protect it from dust and other harmful substances.

APPENDIX F - COMPUTER MAINTENANCE AND CARE

F.1 INTRODUCTION

The Model 2334 requires minimum maintenance and care to keep it operating properly. This appendix gives a brief description of the proper maintenance procedures for the computer, the disk drives, and the removable media.

F.2 THE WORKING ENVIRONMENT

A proper environment for the computer means placing the unit within the appropriate temperature, humidity, and altitude ranges. The computer can operate in a fairly wide range of temperature, humidity, and altitude environments. For the best performance of the computer and for the comfort of the operator, however, it is better to place the computer unit in a middle range of these environmental ranges. It is important that the environmental conditions not change abruptly. Refer to Appendix A for a table of the environmental ranges.

NOTE

Do not use the top of the computer cabinet for a storage or work surface.

F.3 CLEANING THE COMPUTER

If the housing of the computer needs cleaning, spray a small amount of a mild household cleaner on a clean, soft, cotton cloth and gently wipe the surfaces. Be careful not to get any liquid into the computer's operating mechanisms by spraying cleaner directly on the cabinet. For printer, terminals, or other peripherals, refer to the user's manuals for the equipment for cleaning instructions.

Clean the floppy diskette drive at least every six months. The cartridge tape drive should be cleaned after every eight hours of use. Floppy diskette and cartridge tape cleaning supplies are available from Motorola. Follow the instructions enclosed with the cleaner.

F.4 CARING FOR THE REMOVABLE MEDIA

To prevent loss of data or damage to the floppy diskettes and the cartridge tapes, store them in a protected location which meets the following requirements:

- No direct sunlight
- No sources of magnetization
- No dust

- Temperature range from 50 degrees to 125 degrees F (10 to 40 degrees C), or as stated on the floppy diskette or cartridge cover (may vary from one manufacturer to another). Try to place the floppy diskettes and tape cartridges in the middle of this temperature range for best storage results.

- Relative humidity range from 8% to 80%. The best storage humidity environment is at the middle of this range.

- To prevent damage to data on the floppy diskettes or tape cartridges, avoid touching the exposed surfaces or breaking open the protective coverings on the media.

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SUGGESTION/PROBLEM REPORT

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